



# THE UNIVERSITY *of* EDINBURGH

This thesis has been submitted in fulfilment of the requirements for a postgraduate degree (e.g. PhD, MPhil, DClínPsychol) at the University of Edinburgh. Please note the following terms and conditions of use:

- This work is protected by copyright and other intellectual property rights, which are retained by the thesis author, unless otherwise stated.
- A copy can be downloaded for personal non-commercial research or study, without prior permission or charge.
- This thesis cannot be reproduced or quoted extensively from without first obtaining permission in writing from the author.
- The content must not be changed in any way or sold commercially in any format or medium without the formal permission of the author.
- When referring to this work, full bibliographic details including the author, title, awarding institution and date of the thesis must be given.

**Robert Jameson, Geology and Polite Culture,  
1796-1826: Natural Knowledge Enquiry and  
Civic Sensibility in Late Enlightenment  
Scotland**

STUART DAVID HARTLEY



Ph.D. THE UNIVERSITY OF EDINBURGH 2001



September 2001

I declare that this thesis is my own work throughout



Stuart Hartley  
Science Studies Unit  
Edinburgh University

# ABSTRACT

The central figure in this thesis is Robert Jameson (1774-1854), geologist, mineralogist and Professor of Natural History at the University of Edinburgh. Jameson's geological work is examined in relation to the social and intellectual interests of contemporary civil society, and in particular, in terms of the debates in Edinburgh between Huttonians and Wernerians (of which group Jameson was one) concerning the nature of geological evidence and of theory in geological explanation.

This thesis is also concerned to bring into sharper focus the state of, and public interest in, the earth sciences in Scotland in the first two decades of the nineteenth century. In this regard, analysis centres upon the conceptual basis and scientific methods behind Jameson's work and upon the making of natural knowledge as a situated intellectual and social concern. The thesis has eight chapters. Following an introduction and literature review they are, respectively, concerned with showing that in societies, teaching, museology, fieldwork, laboratories and through publications, Jameson's scientific 'methodology' conformed in large part to the Baconian taxonomic and descriptive elements of Wernerianism.

This thesis also suggests that scholars have hitherto misrepresented and overplayed the 'theoretical' nature of Jameson's work, and in so doing, have only characterised the debate between Huttonians and Wernerians as a conflict between rival theories. In re-examining the several activities and the conduct of Huttonians and Wernerians (in this case Jameson) in a variety of settings, a rather different understanding of the nature of debate is here advanced. Specifically, it is shown that rivalry between Huttonians and Wernerians in the sites stated above might be better understood not in terms of two opposing theories, but, rather, as a rivalry between a vigorously held theory on the one hand (proponents of Huttonianism) and, on the other, a conviction about the prematurity of theory and importance of a Baconian empirical approach. The thesis also suggests that understanding the intellectual contexts to such geological enquiry depends importantly upon knowing something of the social and civic nature of scientific 'ownership', institutional authority, personal reputation and the proprietorial control of local scientific knowledge.



# CONTENTS

ABSTRACT ..... i

CONTENTS ..... ii

ILLUSTRATIONS..... vi

ACKNOWLEDGEMENTS..... viii

ABBREVIATIONS IN THE TEXT ..... ix

INTRODUCTION..... 1

1 SETTING THE SCENE: JAMESON IN CONTEXT ..... 11

1.1 Introduction ..... 11

1.2 Geology in Scotland, 1796-1826..... 11

1.3 A ‘Culture’ of Theory: Hutton and Werner Compared ..... 13

1.3.1 HUTTON AND THE APPLICATION OF GEOLOGICAL THEORY ..... 16

1.3.2 HEIRS: HUTTONIANS AND WERNERIANS IN EDINBURGH ..... 19

1.3.3 WERNERIAN ‘RESISTANCE’ ..... 21

1.4 Robert Jameson (1774-1854): A Biographical Sketch..... 22

1.4.1 THE LEGACY OF FREIBERG: WERNER AND THE *BERGAKADEMIE*..... 28

2 CONVERSATION: LEARNED SOCIETIES ..... 30

2.1 Introduction ..... 30

2.2 A Huttonian Fortress: The Royal Society of Edinburgh ..... 31

2.2.1 CONTROL: HUTTONIAN GEOLOGY AND THE RSE ..... 34

2.3 The Wernerian Natural History Society ..... 40

2.3.1 THE WERNERIAN SOCIETY’S *MEMOIRS* ..... 42

2.3.2 THE SOCIETY’S MEMBERS..... 45

2.3.3 THE WERNERIAN SOCIETY AND THE PUBLIC..... 50

2.3.4 THE END OF THE WERNERIAN NATURAL HISTORY SOCIETY ..... 52

2.4 Conclusion..... 53

<b>3</b>	<b>INSTRUCTION: GEOLOGICAL TEACHING .....</b>	<b>55</b>
3.1	Introduction .....	55
3.1.1	NATURAL HISTORY TEACHING AT EDINBURGH UNIVERSITY (1790-1820).....	56
3.2	Jameson's Geological Teaching .....	59
3.2.1	JAMESON'S CLASSES .....	60
3.2.2	STYLE: JAMESON'S APPROACH TO TEACHING .....	61
3.2.3	METHODS: JAMESON'S NATURAL HISTORY COURSE .....	67
3.3	Conclusion.....	77
<b>4</b>	<b>DISPLAY: MUSEUMS AND MINERAL COLLECTIONS .....</b>	<b>79</b>
4.1	Introduction .....	79
4.2	Proprietary Concerns and Museum Impropriety.....	80
4.2.1	JAMESON'S PROPRIETARY NATURE: COLLECTION BUILDING .....	82
4.2.2	MUSEUM ACCESS: WORKING CONDITIONS AND SCIENTIFIC REPUTATION .....	86
4.2.3	ARRANGEMENT: THE NATURE OF DISPLAY.....	90
4.3	Biased Rocks: Jameson and Huttonian Collections .....	93
4.3.1	JAMES HUTTON'S COLLECTION.....	94
4.3.2	FURTHER CONFLICT: JAMESON AND GEORGE MACKENZIE'S COLLECTION.....	103
4.4	Huttonian Collectors: Thomas Allan and Ninian Imrie.....	105
4.5	Conclusion.....	110
<b>5</b>	<b>OBSERVATION: THE USE OF THE FIELD.....</b>	<b>112</b>
5.1	Introduction .....	112
5.1.1	TRAVEL IN SCOTTISH ENLIGHTENMENT CULTURE .....	114
5.2	Robert Jameson and the Field.....	116
5.2.1	EARLY EXCURSIONS, 1794 AND 1796.....	118
5.2.2	ARRAN, 1797 AND 1799 .....	118
5.2.3	THE HEBRIDES, 1798.....	121
5.2.4	ORKNEY, 1799 .....	128
5.2.5	DUMFRIES, 1802 .....	131
5.2.6	MINERALOGICAL WALKS, 1811-1816.....	134
5.3	Early Huttonian Fieldwork: Sir James Hall, 1781-1791 .....	138
5.3.1	VOLCANISM: THE MEDITERRANEAN .....	143
5.4	Later Huttonian Fieldwork: Sir George Mackenzie, 1810 .....	150
5.4.1	ICELAND AS FIELD SITE: INFLUENCES AND PRECURSORS .....	151

5.4.2 THEORY IN THE FIELD: MACKENZIE'S EXPEDITION (1810) .....	153
5.4.3 'HARD' EVIDENCE: THE EXPEDITION ROCK SPECIMENS .....	153
5.5 Conclusion .....	157
 6 EXPERIMENTATION: THE USE OF CHEMISTRY .....	159
6.1 Introduction .....	159
6.2 Experimental Geology in Scotland: Origins .....	160
6.3 Huttonian Chemists .....	164
6.3.1 POPULARISING CHEMISTRY: THOMAS HOPE (1766-1844) .....	165
6.4 Sir James Hall: Experiments and Huttonian Theory .....	168
6.4.1 WHINSTONE AND LAVA .....	175
6.4.2 EXPERIMENTS ON COMPRESSION .....	180
6.4.3 EXPERIMENTAL SPACES: CONDITIONS AND LOCATIONS .....	181
6.4.4 HALL'S EXPERIMENTS IN REVIEW .....	183
6.5 Conclusion .....	184
 7 LITERARY PRODUCTIONS: PUBLICATIONS AND THE PRESS .....	186
7.1 Introduction .....	186
7.2 Geology and the Book: Publishing in Edinburgh .....	187
7.2.1 A TAXONOMIC APPROACH: JAMESON'S BOOKS .....	188
7.2.2 JAMESON AND THE OBSERVATION OF OTHERS .....	192
7.2.3 HUTTONIAN LANGUAGE: GEORGE MACKENZIE'S <i>TRAVELS IN ICELAND</i> .....	195
7.2.4 <i>TRAVELS IN ICELAND</i> : THEATRE AND PUBLIC PERFORMANCE .....	200
7.2.5 THE SCIENTIFIC JOURNAL .....	203
7.3 Geology and the Edinburgh Periodical Press, 1800-1820 .....	205
7.3.1 THE <i>EDINBURGH REVIEW</i> .....	206
7.4 Conclusion .....	216
 8 CONCLUSION: ROBERT JAMESON, GEOLOGY AND THE EARTH SCIENCE COMMUNITY, 1796-1826 .....	218
8.1 Introduction .....	218
8.2 Reflections on Robert Jameson .....	223
8.2.1 JAMESON AND GEOLOGICAL THEORY .....	225
8.3 Conclusion .....	228

APPENDENDICES ..... 230

*Appendix 1* ..... 230

*Appendix 2* ..... 243

*Appendix 3* ..... 246

BIBLIOGRAPHY ..... 254

# ILLUSTRATIONS

## Frontispiece

Portrait of Robert Jameson by George Watson, (Pg 2054). By Permission of the Scottish National Portrait Gallery

## List of Figures

- Figure 1. Extract from student notes of Jameson's lectures by J D. Forbes, 1827-8 showing Plutonic and Neptunian aspects of Salisbury Crags being taught. NLS MS 3936 f62. By permission of the National Library of Scotland. 71
- Figure 2. The College Museum of Edinburgh. By Permission of Edinburgh University Library 81
- Figure 3. Portrait of Thomas Allan [Anon]. By Permission of the National Museum of Scotland. 107
- Figure 4. Extract from Jameson's *Outline of the Mineralogy of the Scottish Isles* (1800). Showing the party measuring a 'perforated basalt vein' on the Isle of Jura. By permission of Edinburgh University Library. 123
- Figure 5. Sketch of Granite veins from Jameson's *Mineralogy of the Scottish Isles*, (1800). By permission of Edinburgh University Library. 124
- Figure 6. Jameson's sketch of a scene on Skye from *Mineralogy of the Scottish Isles*, (1800). By permission of Edinburgh University Library. 126
- Figure 7. Extract from Hall's diaries in NLS MS 6325, showing notes and sketch of a volcanic dyke. By permission of the National Library of Scotland. 140
- Figure 8. Portrait of Sir George Mackenzie [Artist unknown] presumably in private collection. Taken from Kark and Moore, (1981). 150
- Figure 9. Photograph of the Mackenzie collection, R368, taken by the author in 1996. By permission of the Hunterian Museum, Glasgow. 156
- Figure 10. Portrait of Sir James Hall (Pg 2990) By Angela Kauffman. By permission of the Scottish National Portrait Gallery. 165

- Figure, 11. Sir James Hall sketched as an old man. Part of the collection of Naysmith prints and drawings, NLS MS 3242. By permission of the National Library of Scotland. 170
- Figure 12. *The Craft in Danger*, by John Kay, (1817). Picture From *Kay's Portraits* Vol. 4. By permission of the National Library of Scotland. 215
- Figure 13. 'Old Dr Jameson' at the Geological section, by James Naysmith. British Association, 1850. NLS MS 3242 f68 no. 157. By permission of the National Library of Scotland. 224

# ACKNOWLEDGEMENTS

I owe a great debt to many individuals that have assisted me in the preparation of this work. First, I would like to thank my supervisors, Dr. John Henry and Professor Charles Withers, for their advice and critical guidance, unfailing support and encouragement. Second, thanks go to my examiners, Professor Hugh Torrens and Dr W D I Rolfe, for help and for providing additional materials and support.

I would also like to thank a number of people who have helped in the 'construction work': To Dr. Andrew Grout for encouraging my interest in the history of geology even during difficult stages; Steve Cusack and Ian Bastow for painstakingly proof-reading drafts; and Neil Hartley for help with scanning and copying. Thanks also to Carole Tansley for putting up with my eccentricities, opening doors when I have forgotten my keys and for being forgiving after raiding the cake tin during late night writing sessions. Thanks also to members of the Science Studies Unit for helpful hints during coffee breaks and for providing an enjoyable atmosphere within which to work.

Although there are many who have endured me 'rambling on' about this thesis, I owe a special mention to some close friends whom I have been honoured to meet. Without their advice, support, and unfailing encouragement both 'on and off the field' I would never have completed, and certainly not had as much fun. Thanks to Tony Dickinson, Nick Lancaster, Julian Cawston, Frances Wignall, John Abbott, Daniel Park, Nick Odoni, Max Clark, Emily Austin and Stu Savigar.

Finally, I owe the greatest debt of gratitude to my parents, for not only providing the financial assistance without which the project would never even have begun, but also for having constant faith. I dedicate this thesis to them in recognition of their unconditional love and support.

# ABBREVIATIONS IN THE TEXT

**Note:** Because footnotes are included in the text as part of the maximum number of words permitted, references to sources are given in short title form, author only. Full references are given in the bibliography.

ACC	Accession
ANH	Archives of Natural History
BAAS	British Association for the Advancement of Science
BGSE	British Geological Survey Library, Edinburgh
BJHS	British Journal for the History of Science
BM	British Museum Archives
BMNH	British Museum of Natural History
Dept.	Department
<i>DNB</i>	<i>Dictionary of National Biography</i>
DSB	Dictionary of Scientific Biography
DTC	Dawson-Turner Collection
Ed Rev.	Edinburgh Review
<i>ENPJ</i>	<i>Edinburgh New Philosophical Journal</i>
EPJ	Edinburgh Philosophical Journal
EPL	Edinburgh Public Library
ESH	Earth Sciences History
EUSC	Edinburgh University Special Collections
Govt.	Government
GSL	Geology Society of London
HS	History of Science
MJMS	Monthly Journal of Medical Science
MS	Manuscript
MWNHS	Memoirs of the Wernerian Natural History Society
NLS	National Library of Scotland, Edinburgh
NMS	National Museum of Scotland Library
<i>PJ</i>	<i>Phrenological Journal</i>
<i>Phil Mag.</i>	<i>Philosophical Magazine</i>
Proc.	Proceedings
RSE	Royal Society of Edinburgh
SAUL	St. Andrews University Library.
SRO	Scottish Record Office, Archives.
<i>TRLA</i>	<i>Transactions of the Royal Irish Academy</i>
<i>TRIS</i>	<i>Transactions of the Royal Irish Society</i>
<i>TRSE</i>	<i>Transactions of the Royal Society of Edinburgh</i>
UCLL	University College London, Library
UGM	University of Glasgow Museum
WNHS	Wernerian Natural History Society



For  
*Peter and Lorna Hartley*

# INTRODUCTION

Now what I want is facts. Teach these boys and girls nothing but facts. Facts alone are wanted in life. Plant nothing else, and root out everything else. You can only form the minds of reasoning animals upon facts:     *Mr Gradgrind, in 'Hard Times' (Dickens, 1851)*

Nothing in science – nothing in life, for that matter – makes sense without theory. It is in our nature to put all knowledge into context in order to tell a story, and to recreate the world by this means.     *Edward O. Wilson in 'Consilience' (1996)*

Both of these statements reveal a great deal about the complexities of understanding the natural world. But they also do more: they highlight a distinction in method that began with the interpretation of nature via the interplay of inductive and deductive processes. This thesis is concerned with understanding the nature of that enquiry as it was apparent and understood for geology in the first two decades of the nineteenth century in Scotland.

As Laudan rightly suggests, there was not, for geologists of the period, a simple distinction between ‘speculators’ and ‘empiricists’: all geologists expected theory or ‘system’ to play a role. The point at issue was not whether to opt for theory or fact gathering. It was, rather, the relationship between theory and facts that was important.<sup>1</sup>

Perhaps nowhere was this more true than in late Enlightenment Scotland. Of the sciences, the most important for geology as it was taught in the University of Edinburgh was natural history. With its descriptive method and encyclopedic scope, Francis Bacon himself even referred to it as the “great root and mother” of all the sciences and made it the prelude to his experimental philosophy.<sup>2</sup> Foucault identified taxonomic thinking in science as a ‘stage’ process with temporal dimensions. Terming it, the ‘classical

---

<sup>1</sup> Laudan (1987), 8.

<sup>2</sup> What also separated out natural history according to Foucault was that it did not imply a search for causes but was intent on merely describing and classifying natural forms. Thus, such disciplines as botany, zoology, and mineralogy were firmly rooted within a Baconian taxonomic schema. In the *Order of Things* (1966/70) Foucault gave a definition of nature in what he called the ‘classical episteme’ as primarily descriptive and taxonomic, based on external appearances without regard for ‘internal structure’. All

episteme', Foucault identified the late eighteenth century as the period where classificatory science or 'representation' was being replaced by new sciences concerned with 'internal structure'.<sup>3</sup> Despite not including geology in her analysis, Laudan notes that Foucault failed to consider the move from representation to analysis as a process that occurred in the development of every science.<sup>4</sup> In the context of this thesis, I also suggest that this notion of change varied between individual scientists.

By the end of the eighteenth century, geology in Scotland was emerging out of natural history, and incorporating new methods, the complexities of which manifested themselves in what came to be known as the Huttonian-Wernerian conflict that 'ragged', at various levels of intensity, between 1780-1820. It is also possible to see different methodological approaches behind the foundations of Huttonian and Wernerian ideas. It is ironical, then, that this debate has rarely been portrayed as a conflict of methodology but only, rather, as one conducted between rival causal theories (Huttonian/Wernerian).

Methodological differences were apparent. As Laudan argues, Werner's theory was shaped by Becherian mineralogical cosmogony and botanical taxonomy. Hutton, in contrast, followed Newtonian methods, his *Theory of the Earth* being influenced by deism and by a belief in the balanced interaction of the concepts of 'matter' and 'power'.<sup>5</sup> Laudan argues that what transpired for these methods was a spectrum which determined the relations between causes and effects. They were: hypothesis, analogy, enumerative induction, eliminative induction and *vera causa*, otherwise known as the Newtonian method of 'true causes'.<sup>6</sup>

The main concern in this thesis is to establish a clearer understanding of how these methods were used amongst scholars of geology in Edinburgh with the central

---

sciences intent on understanding nature, apart from the physical sciences, were broadly termed under the guise of 'natural history'.

<sup>3</sup> Albury and Oldroyd (1977). Oldroyd also noted that Jameson, along with Fredrich Mohs (1773-1839), believed that the basic principles of a natural history of mineralogy should be based on an analogous hierarchical system using a quasi-Linnean organisational structure. It shows that the activity might also run counter to Foucault's claim (1966/70) that the beginning of the nineteenth century symbolised the end of the 'classical episteme'.

<sup>4</sup> Laudan (1987), 86.

<sup>5</sup> Laudan (1987), 124.

<sup>6</sup> Laudan (1987), 10.

character for investigation being Robert Jameson, (1774-1854), Professor of Natural History in the University of Edinburgh. My initial concern is to establish what Jameson's methodology was, before then moving to ask what consequences it had for understanding the nature and sites of geological debate. Upon closer examination I show that Jameson carried out much of his knowledge enquiry through use of Baconian inductivist methods, and, although opting for Wernerian theory, may now be shown, through detailed analysis of his non-verificationary scientific methodology, not to be the avid promoter of it in Scotland in the manner in which many orthodox historical accounts have portrayed him.

At the core of geological debate at this time was the Huttonian theory of the earth and its opposition known as the Wernerian theory. Scholars, in particular, Laudan and Dean, discuss differences between Huttonian and Wernerian theories, but they have not examined in detail the precise position of Jameson within the Wernerian schema.

Historical accounts of Jameson are not only relatively few: they are also mostly inaccurate. It is my intention, therefore, not only to provide new evidence about Jameson's character, but to give a revisionist account of his geology and to demonstrate why orthodox histories have labelled him so incorrectly.

How has Robert Jameson been labelled? Throughout the later nineteenth and twentieth century a number of Whiggish interpretations emerged. Amongst the most famous (and discussed by Oldroyd) was Archibald Geikie's account (1878-80), in which he "found the Saxon theories of Abraham Werner espoused by Robert Jameson, an utter anathema".<sup>7</sup> Geikie explicitly compared the methods of Jameson with those used by the officers of the Geological Survey in the latter part of the nineteenth century. Jameson was described in scornful terms, Geikie considering his introduction of Wernerian doctrines into the Scottish domain as having "produced an effect on the progress of geological science ...[that] was disastrous", to the effect that it "almost extinguished 'true geology' in Scotland".<sup>8</sup>

---

<sup>7</sup> Oldroyd (1980), 444.

<sup>8</sup> Geikie A, (1878-80), 231, in Oldroyd (1980), 445. Oldroyd has pointed out that Ospovat has recently managed to reinstate the reputation of Werner.

Gillispie's classic account in *Genesis and Geology* (1959) defined and interpreted Jameson's character thus:<sup>9</sup>

In Britain, the Wernerian forces were organised and led by Robert Jameson... Jameson was an indefatigable mineralogical observer, and he and his school professed to regard their geognosy as a subordinate feature of the main science, mineralogy. In practice, however, he became so absorbed in defending neptunist theory against vulcanist criticism that he found himself forever calling mineralogical observation to the support of Wernerian formation suites.<sup>10</sup>

Whilst the statement correctly shows a theoretical and non-theoretical side to Jameson's science, I will show that the balance has been distorted. Gillispie alluded to Jameson's Baconian interests as a mineralogical observer, but suggested that these mineralogical observations were conducted only for the promotion of a theoretical cause. I will provide evidence here to show that whilst Jameson did attach importance to 'formations', he did so only through Baconian methods and not for the sole purposes of establishing theoretical proof.

In the 1960s and 1970s, Robert Jameson's most thorough biographer, Jessie Sweet, directed her studies neither at label fixing nor at the establishment of scientific 'reputation', but upon information about Jameson's travels and correspondence. In her paper on Jameson and Wernerianism, however, she described him thus:

Robert Jameson had given clear evidence that at the time [1796] he had embraced the Wernerian theory of the earth, of which, in later years he was to become one of the greatest apostles and so to influence the course of geological science in the first part of the nineteenth century.<sup>11</sup>

Sweet did not highlight the distinction between the taxonomic and theoretical aspects of Wernerianism. Whilst she was right to note Jameson as a Wernerian theorist, I will show that the label of theoretical 'apostle' might no longer be deemed appropriate for Jameson. Chitnis (1968) followed this usage, describing Jameson as the "apostle of

---

<sup>9</sup> A few other authors have put forward works on Jameson but within a less critically interpretive historiographical framework. Jessie Sweet's articles dealt more with a view of the geological aspects of Jameson's training and more with his personal life, offering no direct analysis or systematic historical examination of the nature of his Wernerianism or the role of the Wernerian theory in a wider setting.

<sup>10</sup> Gillispie (1959), 67.

<sup>11</sup> Sweet (1967a), 81.

Wernerianism”.<sup>12</sup> The *DNB* and *DSB* continued in a similar vein noting Jameson to be: “the acknowledged leader of the Scottish Wernerians”.<sup>13</sup>

More recent attempts in the 1990s have been less Whiggish in their approach and have, at least, begun to address the importance of Jameson’s non-theoretical side. In 1996, Oldroyd recognised Jameson’s taxonomic work, noting: “even in Britain, the land of Hutton, Wernerian geological theory, as well as the rock and mineral taxonomies, continued to reach a wide audience well into the nineteenth century, chiefly through the efforts of Robert Jameson in Edinburgh”.<sup>14</sup>

Secord is more sympathetic to the classificatory aspects of Jameson’s geology, noting that Jameson emphasised order in his classes and that difficult issues could be approached by students only after their minds had been disciplined by the activities of classifying and naming.<sup>15</sup> He has also recognised that there were some attempts to rehabilitate Jameson’s reputation but that in the light of there being no revisionist account, he is still best known as a defender of Werner’s theory:

Within the current picture of early nineteenth-century British science, it is hard to imagine a more improbable advocate of a dangerous and novel theory than Robert Jameson. Despite various attempts to rehabilitate his reputation, he is still best known as a defender of the Neptunian geological theories of Abraham Gottlob Werner.<sup>16</sup>

It is not my concern in this thesis to seek, axiomatically, to redress the balance and offer a much-needed full scale ‘rehabilitation’. My aims are twofold: firstly, to seek new information about Jameson’s non-theoretical activities in geology, and, secondly, to redress the imbalance of orthodox accounting by presenting his ‘theoretical’ side in a new ‘toned-down’ light. I want to consider this by offering a systematic historical examination of Jameson’s early geological activities and methods in various social settings and to do so in ways consistent with some recent work in the history of science.

---

<sup>12</sup> Chitnis (1968), 187.

<sup>13</sup> *DSB*, 69.

<sup>14</sup> Oldroyd (1996), 199.

<sup>15</sup> Secord (1991a), 138.

<sup>16</sup> Secord (1991b), 3.

This work falls within the general rubric of the study of science as a social construction and as practical activity. It is, therefore, informed by developments in the tradition in social history of science that refers to works in the sociology of scientific knowledge (SSK).<sup>17</sup> The subject matter conforms to what Golinski terms 'constructivist sociology' because it is built upon the supposition that science can be understood by investigation of its observable practices.<sup>18</sup>

This thesis is also about the 'situated' nature of scientific activity. I have chosen to focus and build upon ideas concerning 'spaces of knowledge', a recent formulation of geographical approaches in the history of science. Spatial imagery attaches insight to the site. The locales in which scientific knowledge is produced are not seen as passive backdrops but as vital constitutive settings in the production, validation and dissemination of scientific knowledge.<sup>19</sup>

Situated sociological studies of science have mostly concentrated on laboratories.<sup>20</sup> Here I show how comparisons can be drawn for museums, fieldwork, societies, institutions, and publishing. Taken together, the considerations of social interaction amongst scholars and the study of the particular locales – public, semi-public and private – form an important part of this thesis, even-though the primary focus of the work is on the production of natural knowledge within those sites. I have chosen a number of localities with which to view Jameson's approach to geology and here attempt to understand the nature of their relationship and show that Jameson's work in all of them followed a similar methodological path.

Given attention to situation, this thesis also highlights a distinction within this context that refers to locales as either 'public' and 'private'. Historically, the eighteenth

---

<sup>17</sup> The sociology of scientific knowledge (SSK) as expressed through the 'Strong Programme' is based on the assumption that all knowledge has social variables. The programme's founding proposition that science could be studied like other aspects of human culture with regard to truth or falsity of its claims was controversial amongst philosophers and historians. For a precise exposition of SSK, (particularly as it has been developed at the Science Studies Unit at Edinburgh University), see Bloor (1976), Barnes (1974), (1977), (1982), Shapin (1982), Shapin and Schaffer (1985).

<sup>18</sup> Golinski (1998). Many studies are based on this notion. Golinski suggests that the best exploration of the constructivist perspective drawn from historical case studies is Barnes, Bloor and Henry (1996). Earlier known by Bloor as 'naturalism', it is explained by Golinski as being inaugurated by a determination to explain the formation of natural knowledge without engaging in assessment of its truth or validity.

<sup>19</sup> Morrell (1971), 2.

<sup>20</sup> Latour (1983), Latour and Woolgar (1979/1986), Golinski (1998), Agar and Smith (1998).

century witnessed scientific activity moving into what Habermas described as the “public sphere”.<sup>21</sup> By this he meant, in short, salons, coffee-houses, public houses and recreational assemblies.<sup>22</sup> As it relates to this thesis, certain sites may be deemed ‘public’ and others not. Locations such as those discussed in chapters two and seven moved from private to public, and in doing so the debating arenas elicited forms of theatrical behaviour. Other locations do not so neatly reflect this passage from private to public. Chapters four and five show that natural knowledge was constructed differently in museums and in the field. For museums, knowledge was created through the process of display. It is the act of showing and the ordering of material that makes knowledge known: objects being studied for their visible surface features.

The fieldwork sciences (in which geology was included) do not merit a ‘located’ constructivist reading because they are mobile empiricist practices. As Golinski suggests, however, a constructivist analysis is beginning to emerge despite little attention to the historiography of fieldwork thus far.<sup>23</sup> Models of science’s making used for the laboratory would not be applicable here. Attention to the ways geological knowledge moves in and out of certain spaces and across social boundaries and assumes importance through its visual representations and collected specimens may be of more obvious relevance. For Jameson, his fieldwork was relevant in an Edinburgh context despite the actual ‘knowledge-producing practices’ not being bound to any delimited space.

Finally, a note on biography. Although this thesis is in large part a study of the early geological life of Jameson, it is not intended as a biographical account *per se* so much as a reassessment of the nature of geological debate in late Enlightenment Scotland in the light of a new understanding of his methods and activities. That said, I am in agreement with Shapin and Thackray (1974), about the relative merits of biographical studies.<sup>24</sup> The thematic structure of the thesis avoids a direct chronological

---

<sup>21</sup> Habermas (1962/1989).

<sup>22</sup> Recent studies of science in the public sphere are Golinski (1992), Broman (1998), Wood (1994), and more recently for geography, Withers (1999).

<sup>23</sup> For a thorough discussion, see Golinski (1998), 98-102. Kucklick and Kohler (1996).

<sup>24</sup> Shapin and Thackray (1974).



account of Jameson's life and work although it gestures toward a fuller biography of Robert Jameson as one of Britain's most neglected scientific figures.

The thesis has the following structure. *Chapter One* is a general introduction to the social setting in which Jameson's activities and interactions with others took place. Here I outline the theories which were disputed and offer a biographical sketch of Jameson's early life.

*Chapter Two* begins by examining natural knowledge enquiry through its discursive construction in scientific societies. I show that the Royal Society of Edinburgh (RSE) was dominated by members who favoured Huttonian theory, and who used the forum in a civic sense as a political tool. The goals of the Wernerian Society were different from the RSE, interested as it was more in the promotion of an inductive natural history with few theoretical inferences.

*Chapter Three* is about Jameson's role as lecturer in the University of Edinburgh. I demonstrate, through an assessment of teachers and pupils, new insights about his approach to geological teaching. I place particular emphasis both on Jameson's *style* of teaching and the *nature* of the subject matter. I show that the Wernerian theory (although taught) did not dominate his overall agenda and that his natural history syllabus suggested that naming and classificatory methods based upon the external appearances of phenomena in large part took precedence over the theoretical methods of enquiry. Further, I also show a gradual incorporation of Huttonian terminology or allusions to 'plutonic' features into the more theoretical aspects of his teaching.

*Chapter Four* examines Jameson's promotion of geology in the museum. Here I show that geological debate over theory was less of a consideration than issues relating to economics, social status and ownership of property. An examination of Jameson's dealings with Huttonian collections reveal that his concerns centred less on theoretical matters and more upon the assertion of civic reputation, and, particularly, upon his proprietary control of access to the collections. A look at the refutatory management of Huttonian collections in private hands also reveals that Jameson did not use his museum

widely as a tool for promoting Wernerian theory. The displays instead reflected a Wernerian descriptive schema based on Baconian principles.

*Chapter Five* is concerned with geological fieldwork. Here I offer a study of Jameson's activities in the field. The main aims of the chapter are twofold. The first is, in part, biographical. I argue that Jameson's most favoured method of scientific investigation was through direct observation of nature *in situ* and in accord with his Baconian principles. The second concerns an understanding of the nature of field endeavour before the Victorian period in Scotland and its influence on public geological debate. I demonstrate the complexities of field practice and show that although theoretical considerations were present in Jameson's field observations, they occupied only a minor part in as much as they were attained to provide direct proofs. I show the period to be transitional between the methods of those on the amateur 'Grand Tour' and later specialists, between the Baconian empiricist observer and the verificatory stance of the geological theorist. In this chapter, I challenge the orthodoxy of Jameson's 'labelling' through an examination of his other activities. The relatively small amount of secondary literature that exists for Jameson has, I argue, concentrated too much on his activities as Professor and as Museum Keeper. I will demonstrate that he was also an eminent and highly skilled field geologist who travelled extensively.<sup>25</sup> Further, I argue that he may even have pioneered the use of fieldwork for pedagogic purposes in British universities.

*Chapter Six* examines verificatory procedures in geology through chemical experimentation. I show Jameson to be sceptical of the chemical method, preferring

---

<sup>25</sup> Yearley's (1984) paper on the use of classification devices in scientific argument provides a fascinating insight into the importance of labelling and classification in shaping peoples perceptions. Through case material on Sir James Hall (see chapter 5), Yearley demonstrated that labels function as steps or devices in the conduct of scientific arguments and that scientific reputations occur as the sediment of these processes. Owing to the diverse and richly varied nature of Jameson's activities, it is possible to assign many labels to him. Although literature on Jameson is scant, he has been traditionally represented as either a professor of natural history – a teacher, or as keeper of the museum of natural history. Although there is no doubt as to his theoretical bias in geology toward the doctrines of Werner, Jameson travelled extensively throughout his native Scotland over many years and was a highly skilled mineralogist who undertook much detailed empirical geological work. To date he is not so well known for these activities and may have been denied this reputation for argumentative purposes "as the labels are used in accounting for correctness and error, the validity of the reputation will rise as the work itself is assimilated to current beliefs". I shall demonstrate in this chapter that Jameson should be assigned a reputation as an

natural history and observation of features in the field. Further, he did not ever advocate the use of the former as a tool for verifying Wernerian theory. In contrast, I show, through an examination of Sir James Hall's use of chemistry how Huttonians were methodologically opposed to Baconianism. The argument of differing intellectual contexts greatly supports the claim made throughout the thesis - that geological debate was not just about theory but was more a reflection of personal and political rivalry and proprietary issues.

*Chapter Seven* is less place-centred than previous chapters. Here I show that Jameson's published works reflect a similar scientific trend to his empirical endeavours: most were not wholly concerned with theoretical propositions. In contrast, I show that Huttonians used the publication actively even militantly, to promote theory in contradiction to most of Jameson's works. I examine the public reaction to Jameson's work by looking at its reception in the Scottish periodical press, in particular, the *Edinburgh Review*. I suggest that the Edinburgh press favoured Hutton's theory and did not laud Jameson's work. This may have led to a false public image of Jameson that is still reflected in late twentieth-century literature about him.

*Chapter Eight* concludes through a general assessment of the state of geological knowledge in Scotland by 1826, in the light of the new understanding of Jameson's role that I have presented. By demonstrating much of Jameson's work to be Baconian and descriptive in character, and playing down his theoretical side, although present, as less defining of his overall persona, I present a new perspective on the nature of debate in Edinburgh. I show that geological engagements in Edinburgh depended upon much more complex circumstances than 'simple' theoretical rivalry alone.

---

expert field geologist and well-travelled scientist and that he may not have been given this reputation by Huttonian rivals eager to present him as non-expert.

# 1

## SETTING THE SCENE: JAMESON IN CONTEXT

### 1.1 Introduction

Jameson, as I have introduced him, represents in the early nineteenth century, one of the last adherents of Enlightenment classificatory methods. The use of Baconian inductivism when many about him were losing their faith in its scientific merit is perhaps the key to why many historical accounts have not considered it an important part of Jameson's work. In what follows, I shall first consider Jameson in the context of his time. My start point is with the place of science in the civic environment of Edinburgh at the end of the eighteenth century and beginning of the nineteenth century.

### 1.2 Geology in Scotland, 1796-1826

The generation of Edinburgh scholars in the first part of the nineteenth century were the first heirs of the Enlightenment. The role of public discourse and experimentation in the culture of eighteenth-century Britain has been the subject of considerable investigation. Echoing interpretations of science in Enlightenment Scotland, Porter has argued that its manifestations in the English provinces should be viewed as a cultural expression by an affluent middle class elite, declaring that "Science, like music, literature or fashion is a cultural form, to be understood historically in relation to social forces such as emulation or consumerism".<sup>1</sup>

---

<sup>1</sup> Porter (1978), 81.

Scottish thinkers such as William Cullen and Joseph Black felt that placing science in the civic realm raised deep moral problems for society and polity. Behaviour in the public spaces of the eighteenth-century was discussed in relation to its implications for individual identity, moral responsibility and social progress.<sup>2</sup> In the context of geology, Porter argues that late eighteenth-century English society provided the social basis not just for expansion but also its channelling into intellectual and institutional forms.<sup>3</sup> So, too, in Scotland, geology's rise was intimately connected with the intellectual and social interests of civil society, and with the scientific understanding of causal connections within earth theory.

Although much is known about social and civic life in Scotland during the later Enlightenment, less is known for geology. Between 1796 and 1826 the science, still in its infancy, underwent a significant transformation from being the amateur pursuit of the landed gentry to a more fully-developed specialised scientific discipline.<sup>4</sup> Jameson's character must be understood in relation to these contextual shifts.

By placing Jameson in context, we must also consider his contribution to the social practices of geological debate. For the Victorian period, cultural studies of geological activity have been amongst some of the most innovative and exciting work in the recent history of science.<sup>5</sup> Studies by Rudwick (1985), Secord (1986), and Oldroyd (1990), for example, show scientific knowledge to have been constructed as a social process in which the consensus acceptance of theories was only achieved by prolonged social interaction. Porter (1977) and Laudan (1987) have considered these topics for pre-1800 geology. No study of the Hutton-Werner controversy, however, exists within these more recent historiographical frameworks. I shall outline the main points of contention at play for late Enlightenment Scotland and consider them, contextually, as cultural manifestations of late Scottish Enlightenment civic and social values.

---

<sup>2</sup> Wood (1994).

<sup>3</sup> Porter (1977), 49.

<sup>4</sup> This is especially the case for England, particularly after the foundation of the Geological Society of London in 1807.

<sup>5</sup> Secord (1986), *Preface*.

### 1.3 A 'Culture' of Theory: Hutton and Werner Compared

The 'neptunist' theory of the origin of rocks developed by Abraham Gottlob Werner (1749-1817) in Freiberg has received considerable attention from historians of science.<sup>6</sup> Werner's ideas outlined in his *Short Classification and Description of the Various Rocks* (1786), radiated widely across international boundaries. Wernerian theory dominated early geological thinking in the late eighteenth century, and was a powerful force amongst eminent earth scientists in Werner's day and remained so until the late 1820s.<sup>7</sup> Werner has also been described by scholars as the 'founder of historical geology' incorporating not only factual and descriptive elements of the contents of the earth's crust, but also speculation about its origins in terms of the first, complete, universally-applicable 'geological' system.<sup>8</sup>

Werner was born in Wehrau, Poland on 25 September 1749. His father, an inspector in the Duke of Solm's ironworks, had connections with mineralogy. It is this, coupled with Werner's early education from his father, that is said to have encouraged his early mineralogical interest. In 1774, on the strength of his first book, *Von der Ausserlichen Kennzeichen der Fossilien*, he was offered a position at the *Bergakademie* in Freiberg as teacher of mining. This he took and was to remain for the next forty-two years. Werner's eventual global recognition emerged from his skill as a teacher at Freiberg, within an institution known to be one of the most illustrious mining schools in the world.

To understand the formation of Werner's thought we have to look to precursors. Laudan has revealed his connections with the tradition of chemical cosmogony.<sup>9</sup> She has traced Werner's heritage back through Oppel, Bergman, Wallerius, Lehmann, Hoffmann and Henkel to Becker, Stahl, and Agricola, claiming that during Werner's career he transformed the Becher-Stahl tradition to make the 'time of formation' of the rocks and not their 'mineralogical content' the most important element of study. This

---

<sup>6</sup> Gillispie (1959); Davies (1969); Ospovat (1967); (1974); (1970-80); Bowler (1992); Laudan (1987).

<sup>7</sup> Laudan (1987).

<sup>8</sup> Ospovat (1969), 256.

<sup>9</sup> Laudan (1987), Chapter Three.

marked the beginnings of Werner's theoretical outlook but it must be stressed that mineralogical content was by no means abandoned or replaced: rather it co-existed.

Others likewise cite certain 'traditions' of thought as influential. Bowler talks of the 'German' theoretical stance adopted at Freiberg, tracing its origins to Agricola in the sixteenth century. This utilitarian approach, adopted to favour mining activity, based its interest in the formation of mineral veins as a chemical process, following the chemical theories of Becher and others. Bowler suggests "the formation of the earth's crust was seen as a process in which precipitation and crystallisation - usually assumed to be from solution in water - played the major roles".<sup>10</sup>

For a comprehensive understanding of the development of Werner's theory, Bowler also cites the work of other influences, notably Lehmann, as responsible for laying the foundations of a global earth system and initiating a 'division' of the earth's crust into distinct 'classes'. This provided, it is argued, the framework of a temporal system for Werner to build upon and develop more fully. Ospovat also cites individuals who might have developed temporal systems: "Werner was well versed in the mineralogical and geological literature of his day, being familiar with the leading exponents of both fire and water as the major agent in the creation of the earth's crust. A list of writers on geology that he prepared includes among others, Steno, Lehmann, Ferber, Hamilton, Fuchsel, Saussure, Buffon, and more".<sup>11</sup> In paying less attention to the others, Ospovat selects Steno in particular, whose work displayed a striking resemblance to Werner's and he was someone with whom, apparently, Werner was familiar.

It is obvious, then, that Werner was exposed to many influences in the construction of his thinking with some taking precedence over others. The precise details, however, do not detract from Ospovat's claim that: "What ever the background of his theories, Werner thought, on the basis of the geological knowledge of his day,

---

<sup>10</sup> Bowler (1992), 126.

<sup>11</sup> Ospovat (1969), 256.

that they were firmly supported by the evidence - a fact which goes far to explain the popularity of his system".<sup>12</sup>

Let me turn to a more precise description of the contents of the Wernerian theory. There is the notion of a temporal dimension described as 'formations'; that denoted a system attempting to be distinctly 'historical' rather than 'causal'. The primary geological agent is deemed to be water. Numerous descriptions exist, most notably in Ospovat (1974, 1976, 1980) Davies (1968), and, more recently, Laudan (1987). Ospovat notes that the two basic postulates of the Wernerian theory were that the earth was once enveloped by a universal ocean and that all the important rocks that make up the crust of the earth were either precipitates or sediments from that ocean. Werner, in his observations, divided the rocks into four (eventually five) distinct classes according to their age of formation. Werner performed this on the *a priori* notion that the characteristics of the rocks were the result of the depth, content, and conditions of the universal ocean at the time when they were formed.

Based on the crystalline nature of the rocks, chemical composition, texture, rock structure and stratigraphy, Werner - in assuming that the waters had receded slowly - postulated four periods of formation which corresponded to classes and he named them, in chronological order, Primitive; Floetz; Volcanic/Alluvial; Transition.<sup>13</sup>

---

<sup>12</sup> Ospovat (1969).

<sup>13</sup> *The Primitive Class*: These were the oldest rocks in Werner's theory. Formed in a primeval universal ocean devoid of extraneous material and life, these first rocks were crystalline chemical precipitates laid down upon an uneven surface of the earth's nucleus - not as horizontal beds - forming rocks that are strongly crystalline, principally granitic masses or Gneisses. As the waters became less calm the rocks of the later primitive period displayed irregularities, therefore explaining their often steeply dipping bedding planes. *The Transition Class*: This was an intermediary class developed later by Werner. It is placed as the second class, even though it was conceived of after the previous four. It was developed as a result of Werner's discovery of fossils in rocks previously classified as primitive. Following the formation of the primitive class the level of the ocean fell, allowing the highest of the primitive rocks to emerge. Subsequent denudation of these exposed masses released clastic sediments. The rocks of this class therefore display a transitional nature, between primary and secondary times. It is also assumed that life forms began to emerge at this time. *The Floetz class*: The volume of detrital material increased considerably, following the further reduction of the universal ocean. Containing fossils, the resultant rocks are clastic sediments. Among the floetz Werner identified, Floetz limestone, floetz gypsum, coal, basalt, old red sandstone and chalk. The low level of the great ocean meant that these rocks did not rise to high levels but instead, covered the flanks of the great primitive mountains forming lowland terrain. *The Volcanic/Alluvial classes*: These periods are almost non-distinct from the floetz period except that these rocks are not accepted as direct deposits from the universal ocean but represent instead, local anomalies. In its final form, the Wernerian theory contained five periods, divided into three that constitute most of the earth's crust as deposits from a universal ocean and two others that more closely reflect local anomalies of later conditions.



The impact of this global system was of major significance for geology and its development as a science. Porter (1977) argues that the outlook of Werner, in relation to the mineralogical and lithological analysis of rock forms, was immensely important for the emergence of geology in directing attention to the mineral history of the globe.<sup>14</sup>

Porter shows this to be especially true as late eighteenth-century mineralogy provided a sequential developmental model of earth history, dividing the rocks into fundamentally different tangible characters according to the epoch in which they were laid down and comprehended within some kind of explanatory mechanism such as the diminishing waters of a universal ocean.<sup>15</sup> James Hutton, in contrast, offered an alternative approach.

### 1.3.1 Hutton and the Application of Geological Theory

The universal system of earth formation propounded by James Hutton (1726-1797) contrasts markedly with Werner's. Hutton's theory - although not widely accepted at first except perhaps in his native Scotland where it was introduced before Wernerianism<sup>16</sup> - eventually became the single most important challenge to the Wernerian geological system in the early nineteenth-century. Hutton's system has been regarded by scholars as fundamental to the understanding of the early development of geology. For this reason, it has been exceptionally well documented.<sup>17</sup> Expositions of the Huttonian system exist from as early as Playfair's *Illustrations* in 1802.<sup>18</sup>

---

<sup>14</sup> Porter (1977), 171.

<sup>15</sup> Porter (1977), 172.

<sup>16</sup> Huttonianism was being taught and debated in Britain and abroad from 1788-90 while Wernerianism only fully took a stronghold in Britain from 1805-8. According to Porter (1977) the RSE was the only place where Huttonian ideas took a stronghold at this time.

<sup>17</sup> James Hutton has been the most extensively discussed figure in geology in the Enlightenment. Dubbed the 'father of modern geology' by Archibald Geikie in the late nineteenth century, the list of those that have written about him and his work is extensive. Amongst the most influential are: Playfair (1805), Dott (1969), Geikie (1905), Gillispie (1959), Eyles (1953), Zittel (1901), Davies (1969), Porter (1977), Laudan (1987), Dean (1992), McIntyre (1963), Hallam (1983), Gould (1987), Bowler (1982), Leveson (1996).

<sup>18</sup> Leveson (1996) recognises two historical schools of thought with specific regard to Hutton's methodology which he calls 'traditional' and 'revisionist' (1996), 61. The 'traditionalists' he recognises as defining Hutton as the 'Founder of Modern Geology', Dott (1969), 122; Geikie (1905), 280; Zittel (1901), 71-72; McIntyre (1963), 2. The 'revisionists', Leveson suggests, make the claim that this misrepresents and overvalues his work, Gould (1987), 66ff; Davies (1969), 154-196, Porter (1977), 3, Laudan (1987), 128, Hallam (1983), 23. This particular argument need not concern us here except to highlight the existence of differing notions of importance with regard to impact of the Huttonian system and to highlight the wide

Hutton was born in Edinburgh on June 3 1726. The only son of a wealthy merchant whose death in 1729 effectively ensured Hutton of a life without a need to earn money, Hutton spent his early life broadening his intellectual pursuits. Possible early influences include John Stevenson, lecturer at Edinburgh University and the first person to stimulate Hutton's interest in chemistry, and Andrew Plummer, under whom Hutton studied medicine as a student in Edinburgh in 1744. It is through Plummer that Hutton may have been acquainted with Boerhaave's work in chemistry.

After spending two years in Paris learning chemistry, Hutton completed his M.D at Leyden [Leiden] and returned to Scotland to pursue a farming career on his Berwickshire estate. He moved to Edinburgh in 1768 (where he remained until his death), and acquainted himself there with Joseph Black (1728-1799), Professor of Chemistry at Edinburgh, John Playfair (1748-1819), mathematician, and, later, geologist and the experimentalist, Sir James Hall (1761-1832). Hutton was one of the founding members of the Royal Society of Edinburgh in 1783 and as one of its most active supporters, first published his *Theory of the Earth* in 1795.

Early ideas for Hutton's theory were first made public at two meetings of the RSE in 1785.<sup>19</sup> He described three principal aims: to ascertain the length of time the earth had existed as a 'habitable world': to discover the changes it had undergone in the past: and to ask whether any end to the present state of affairs could be foreseen.

What Hutton was able to demonstrate was an earth system based on temporal 'cyclicity'. Thus, the earth was - in a metaphorical sense - like a machine with a three-phase engine.<sup>20</sup> The first phase was a period of denudation where the continental rocks would break down into soil masses. The second phase, was depositional, that involved the soil masses being carried to the sea through river and wave action and left as continental debris on the ocean floor. The conversion of the soils back into sedimentary strata would then occur through the mechanism of fusion caused by terrestrial heat. The

---

attention it has received in the historical literature. I am chiefly concerned in this section to present a description of the principal differences of the Huttonian system in contrast to Werner's. Eyles's descriptive account of the life of James Hutton in *DSB* (1953) is among the most concise. It highlights the possible influences in the development of Hutton's thought and places him within his geographical setting, as best understood as a product of Scottish Enlightenment values and attitudes.

<sup>19</sup> *DSB* (1953), 580.

third phase involved the eventual disappearance of the old continental masses and the subsequent formation of new uplifted continents as the newly-consolidated strata were uplifted from the sea floor through expansion from heat at depth. Hutton argued that this process constantly repeated itself and was akin to the denial of history itself, a self-renewing world machine.<sup>21</sup>

To understand how Hutton came to reach his conclusions on this endless cycle of decay and renovation, we have first to assess how he thought it could have operated. The fundamental difference between Huttonian theory and the Wernerian schema was that the former required the agency of heat in causal explanation.<sup>22</sup> For these reasons, Hutton set out a number of pre-conditions for his theory and he did so on Newtonian principles. He postulated that the earth's position in the solar system remained stable<sup>23</sup> and that gravitational forces preserved an essential form of stability. Hutton took Newtonian theory for granted, using it "as a model to solve the more specifically geological problem - namely, how the seemingly chaotic and disorderly surface of the earth was maintained in a habitable state".<sup>24</sup> Hutton acquired the essential basis to sustain this notion of constancy through Newtonian principles of stability. He "constructed his theory in terms of a Scottish interpretation of a Boerhaavian heat theory at a time when almost all his contemporaries were indebted to Stahl".<sup>25</sup> As already stated, the agent of heat is fundamental to a thorough understanding of Huttonian theory. As examples of this, Hutton postulated two possible causes of rock consolidation. Firstly, accretion, understood as a form of deposition from solution and consolidation through water, and secondly, congelation, a fusing through the action of heat and a term he shared with other colleagues.<sup>26</sup>

---

<sup>20</sup> Davies (1969), 160.

<sup>21</sup> Gould (1987), 65.

<sup>22</sup> Arguably the most concise exposition of the mechanistic influences of Huttonian theory has come from Laudan (1987), 124. In seeking to understand fully, the operative process of the system, Laudan sought precursors as far back as Newton.

<sup>23</sup> Laudan (1987), 114.

<sup>24</sup> Laudan (1987), 116.

<sup>25</sup> Laudan (1987), 113.

<sup>26</sup> Laudan (1987), 118.

Hutton rejected accretion as a consolidating agent on the grounds that the materials of which sediments composed are, with a few exceptions, insoluble in water. He adopted the fusion of sediments by the heat that he believed existed beneath the lower regions of the earth's crust. Heat, he claimed "was capable of fusing all the substances in different types of sediment".<sup>27</sup>

Hutton realised that many answers to the problems of consolidation and of uplift could be achieved by adopting the action of a heat force. Rocks could be consolidated without the need for a 'foreign' solvent body, consolidation was possible with all the mineral classes of the globe, not just some, and uplift through expansive force was achievable. Further, Hutton adopted methodological principles that were essential to his clear exposition of the necessary conditions to allow the formulation of such a system. For Laudan, Hutton "relied heavily on the methods of hypothesis and eliminative induction at a time when his contemporaries thought them less reliable than the methods of analogy and enumerative induction".<sup>28</sup>

I have attempted here merely to outline some of the precepts upon which the system was based with particular reference to the way it contrasts with Werner's. Now I will turn attention to the reception and scientific value of theory in late Enlightenment Edinburgh.

### 1.3.2 Heirs: Huttonians and Wernerians in Edinburgh

It was Archibald Geikie who first discussed what he called the characteristic "Scottish School of Geology" in 1871.<sup>29</sup> Geikie here was referring only to James Hutton and his contemporaries, claiming them to be the founders of modern geology in the British Isles.<sup>30</sup> Porter's later suggestion that neither Hutton's work nor his contemporaries' could justly be described as characteristic of geological thinking in Scotland makes the description 'Scottish school' inappropriate in relation to Huttonian ideas, despite their 'stronghold' within the RSE. Indeed, as I have already stated, to be a Huttonian was,

---

<sup>27</sup> Eyles (1954).

<sup>28</sup> Laudan (1987), 113.

<sup>29</sup> Geikie A (1871).

<sup>30</sup> Porter (1977), 150.

numerically speaking and in a European context, to be in a clear geological minority in the first decade of the nineteenth century. Interestingly, in 1873 Geikie changed his original description to the 'Huttonian School'.<sup>31</sup>

Many 'Scottish scholars' were vehemently opposed to Huttonian ideas: in his own time this is well known. It is important, therefore, to identify those calling themselves Huttonian and those who were not. More importantly, however, we must consider and examine the precise nature of the differences between such groups in terms of methodological, social and political factors rather than, simply, rely upon extant interpretations as a straight-forward dispute over rival theories and underlying causes.

Converts to the Huttonian cause established themselves around the RSE. Some have received considerably more attention than others, most notably John Playfair and Sir James Hall.<sup>32</sup> Other important Huttonians not well documented include Lord Webb Seymour, Thomas Allan, Thomas Hope, and Sir George Steuart Mackenzie.<sup>33</sup> By 1813, the Huttonian faction had assumed almost complete control of the RSE with Sir James Hall as president, Lord Webb Seymour one of its two vice presidents, John Playfair as Secretary, Thomas Allan as Keeper of the Museum and Librarian, Sir George Mackenzie as President of the Physical Class and Thomas Hope as Secretary of that class.<sup>34</sup>

Playfair's most important contribution to Huttonian theory was his 1802 work *Illustrations*, a concise account of Hutton's *Theory of the Earth* albeit much more clearly written. As a Newtonian, Playfair adhered to the Huttonian cause on methodological grounds.<sup>35</sup> In believing that Hutton's greatest achievement was his account of consolidation by the action of heat, Playfair's method of expression took the form of

---

<sup>31</sup> Geikie's (1873) paper is entitled, *'Earth Sculpture and the Huttonian School of Geology'*

<sup>32</sup> Although Playfair and Hall are represented as strong supporters of Hutton, it must also be noted that this did not manifest itself in total adherence. Both Playfair and Hall disagreed with Hutton on certain issues, Hall particularly on the question of deluges (for a thorough discussion of this see Yearley (1984), 36-38. I agree with Laudan's view that to be classed a successor to the ideas of its founder one has only to adopt the same position on some issues, though not on every issue, and not necessarily adopting the same doctrines as other converts. For Laudan, "I count someone as a Wernerian if they accept a substantial part of Werner's theory and if they are conscious that it is Werner's": (1987), 105.

<sup>33</sup> Mentioned are supporters of Hutton's cause who were resident in Edinburgh only. Huttonian ideas were also accepted by a number of foreign earth scientists, most notably, A. von Humbolt, Dolomieu, von Buch and Breislak.

<sup>34</sup> Dean (1992), 161.

<sup>35</sup> Laudan (1987), 131.

detailed writings rather than through empirical endeavour. He is still widely recognised by historians as Hutton's foremost spokesman.<sup>36</sup>

In contrast to Playfair's oratorical and rhetorical skills, Sir James Hall's major contributions were derived through experiments within a revived chemical tradition.<sup>37</sup> After initially rejecting Hutton's theory, Hall became convinced of its merits. Throughout the 1790s, Hall made attempts to establish the truth of Hutton's theory through verificatory experiments.<sup>38</sup> Hall is portrayed either as an experimentalist who carried out a series of confirmations of hypotheses put forward by Hutton, or a disciple of Hutton who fundamentally differed from him on the issue of deluges.<sup>39</sup> George Mackenzie was the first successfully to use refutatory field evidence to promote Hutton's theory. Thomas Allan used specimens from his own extensive collection as evidence in constructing Huttonian papers.

### 1.3.3 Wernerian 'Resistance'

When describing the spread of Wernerian ideas in Europe, Laudan used the term 'radiation'.<sup>40</sup> Her understanding of this as "heritage and influence combined with spread and divergence" accurately depicts the popularity of Wernerian doctrines throughout Europe in the late eighteenth century.<sup>41</sup>

Unlike Hutton's heir's - which sees no one individual as the absolute champion of the cause - Wernerian theory in early nineteenth-century Edinburgh is traditionally viewed as almost exclusively the work and dedication of one individual above any other: Robert Jameson. Because of his attachment to the classificatory and taxonomic methods

---

<sup>36</sup> Dean (1983).

<sup>37</sup> Laudan (1987), 133.

<sup>38</sup> Hutton's warning in his own words were "against those who judge of the great operations of the mineral Kingdom from having kindled a fire and looked into the bottom of a little crucible". It is perhaps this view that led to Hall's seven-year lull in experimental procedure: see Eyles (1961), 213. As Yearley (1984) has pointed out, there appears to be nothing that can label Hall an 'originator' in any form, particularly not in experimental geology. This undermines earlier claims portraying Hall as the 'Pioneer of Experimental Geology' by Geikie A (1905/1962), Eyles (1961), Woodward (1907/8), and Flett (1921). Yearley (1984), 26 suggests that far too much attention has been paid to Hall 'the experimenter' and less to his view of geological theory and advocacy of the Huttonian system. Despite Yearley's claim, Hall is still seen as an important founder of experimental petrology in contemporary literature: see Wyllie (1999).

<sup>39</sup> Amongst those who pay more attention to this latter claim are Gillispie (1959), Davies (1969).

<sup>40</sup> Laudan (1987), 102.

of Werner, Jameson also established a belief in Wernerian theoretical doctrine. He was also influenced by two individuals who were students of Werner's, E F D. Camera Bethencourt, a Portugese, and A. Deriabin, a Russian, who came to Edinburgh after studying at Freiberg in 1792-3. He also made early contacts with Richard Kirwan (1733-1812), visiting him in Ireland in 1797. In 1800 Jameson went to study at Freiberg under Werner. Upon his return in 1802, he began immediately expounding Wernerian ideas; a course of action that was continued until his death in 1854.

Jameson's position as Professor provided him with the influence and power to exert Werner's ideas, but, as I shall show, although he was a believer in Wernerian theory, Jameson may now be shown not to have conducted much of his scientific work as a theorist. Chitnis argues that Jameson used the museum to promote the Wernerian theoretical system so much that it should be thought of as an 'abuse'.<sup>42</sup> I shall show this view, and those others in a similar vein, to be misguided.

The followers of Werner in Edinburgh, and close contemporaries of Jameson, are relatively unknown. The Wernerians were at their strongest in Europe throughout the 1790s and although very active in Scotland in the early part of the nineteenth-century, from 1805-8, they were slowly pushed back by localised Huttonian support. Jameson remained resistant to the theoretical nature of Huttonianism until very late in his life. I shall begin my examination, however, by presenting a biographical sketch of Jameson in order to analyse the contextual nature of his geological activities.

## 1.4 Robert Jameson (1774-1854): A Biographical Sketch

Shortly before Jameson's death in April 1854, his friend and pupil Ami Boué notified his concern at the failing health of his mentor:

Your uncle certainly has all the rights to such an honour conferred upon him, his services for science are cosmopolite for his pupils are dispersed over the whole earth's surface, besides that he was the electrical spark which induces especially the beginning of true geognosy in great Britain. The fightings of his Wernerian School with the Huttonian army was a true benefit for science, the unqualified Huttonians were shot down and only the best remained. If many fine fellows of the Wernerian troops did follow also, Professor Jameson remained and could lastly shake friendly the

---

<sup>41</sup> Laudan (1987), 105.

<sup>42</sup> For more on this see Chapter Four.

hands of his former enemies. When his mineralogical works are well known the high knowledge he had in various branches of Natural History is less known notwithstanding he insulated the taste for that branch of knowledge to so many clergymen, medical and scientific men of classes of society.<sup>43</sup>

This was but one of many tributes paid to Jameson for a lifetime of devotion to natural science. Jameson was universally well known and respected throughout his lifetime.<sup>44</sup> Jameson had an international reputation as Professor of Natural History in the University of Edinburgh, a post he held for fifty years (1804-1854). Apart from his teaching, he also engaged in many other tasks in the public domain:<sup>45</sup> as a geologist and advocate of the theoretical views of Werner; as zoologist and botanist; as keeper of the Museum of Natural History; as sole President of his own scientific society,<sup>46</sup> and as editor of his own scientific journal.<sup>47</sup> Despite these many achievements, Jameson still remains the most poorly understood geologist and natural historian in early nineteenth-century Britain.

Robert Jameson was born in Leith on 11 July 1774, the third son of prosperous soap manufacturer, Thomas Jameson and Catherine Paton, a brewer's daughter. Very little is either known about Jameson's early years. He attended Leith Grammar School, the forerunner to Leith Academy, and it is said that he often played truant. He was sometimes forced to school by being taken against his will by one of his father's

---

<sup>43</sup> EUSC Gen. 1999. Ami Boué to Laurence Jameson, Vienna, 23 April 1854.

<sup>44</sup> Although there is very little analysis of Jameson's activities, some descriptive information on Jameson's early life has been documented. Information has been taken chiefly from the *DSB* and *DNB*, Jameson (1854), and Eyles (1954). The most detailed exposition of Jameson's early life is by Sweet (1976).

<sup>45</sup> On the frontispiece of *System of Mineralogy* (1808), Jameson is described as: "Regius Professor of Natural History; lecturer on mineralogy and keeper of the museum in the University of Edinburgh; Fellow of the Royal and Antiquarian Society of Edinburgh; president of the Wernerian Natural History Society; honorary member of the Royal Irish Academy, and of the honourable Dublin Society; Fellow of the Linnean and Geological Societies of London and Royal Geological Society of Cornwall; Fellow of the Linnean and geological societies of Jena". This perhaps gives the most detailed summation of his interests and involvement.

<sup>46</sup> The Wernerian Natural History Society was founded in 1808 by Jameson and eight other colleagues. Jameson remained its President until his death in 1854. The Society was disbanded in 1857 when it became incorporated within the Royal Physical Society and the Botanical Society of Edinburgh: see Chapter Two.

<sup>47</sup> *The Edinburgh Philosophical Journal*. This was founded by Jameson and Sir David Brewster in 1819 and ran for six years. In 1825 Brewster resigned after a dispute, leaving Jameson as sole editor. The Journal then changed its name to the *Edinburgh New Philosophical Journal*. This journal was the original idea of Jameson's friend Dr Patrick Neill and was countenanced and published by Constable. The *Journal* was still in operation at the time of Jameson's death in 1854 and was then considered the most valuable repository of scientific information in Britain.



servants: as Laurence Jameson noted “his heart was not in “*Amo*” but in nature’s glorious works”.<sup>48</sup>

Whilst playing truant, Jameson pursued his interests on the beaches of the Leith area where he would collect shells and insects. As a child he was influenced by such works as Daniel Defoe’s *Robinson Crusoe*, the fantastic adventures of Peter Wilkins, and *A Description of Three Hundred Animals*. Jameson claimed such books to be the overriding influence in his decision to become Professor of Natural History. He was also aware of Captain James Cook’s *Voyages*, as were so many his age and this, coupled with other popular works of the time, led to his desire to study nature.

From an early age, it appears that Jameson acquired a practical interest in natural history. Jameson tried to persuade his father of the benefits of a maritime career. This course of action was against the wishes of Thomas Jameson who never yielded on the matter but, in time, did not try to stop his son from following this course of action. The alternative, he was persuaded by friends as a compromise, would be to take up the study of medicine where he would be able to satisfy the wishes of his father and study the structure of man and the animal kingdom. Jameson went to study medicine under Leith surgeon, John Cheyne.

Jameson first entered Edinburgh University in 1789. He returned periodically until 1796, studying a number of different subjects, but like most students at the time, never graduating. He studied medicine, botany, chemistry and natural history and first became acquainted with the Professor of Natural History, the Rev. Dr John Walker with whom he showed great enthusiasm for the study of nature. Jameson attended Walker’s lectures in 1792 and 1793 proving himself to be such a fine pupil that Walker bestowed the charge of the museum upon him. Through his botanical studies, Jameson also befriended Dr Anderson, whose periodical, *The Bee*, was the first to publish his early mineralogical ideas. Assisted by his father’s wealth, he went to London in 1793 where he met eminent scientific gentlemen such as Sir Joseph Banks, and other prominent members of the London literati, many of whom were members of the Linnean society.<sup>49</sup>

---

<sup>48</sup> Jameson L (1854), 6.

<sup>49</sup> For Jameson’s London tour, see Sweet (1963).

Other contacts included James Parkinson (1730-1813?) owner of the Leverian museum, Dr George Shaw (1751-1813) of the British Museum and Sir Alexander Crichton (1763-1856). Jameson attended a meeting of the Linnean Society, presided over by its founder Sir James Edward Smith (1759-1828), and met Dr Coakley Lettsom (1744-1815), owner of a valuable mineral collection. Lettsom's collection was, along with those in the Leverian and British Museums, studied carefully by Jameson and his accounts of them seem to have spurred his interest in, and knowledge of, mineralogy.<sup>50</sup>

Of particular importance for the furtherance of Jameson's interest in mineralogy were his meetings with Sir Joseph Banks.<sup>51</sup> According to Sweet, it was during his London excursion that Jameson was "advised (probably by Dr Shaw) to give up most of his medical studies (with the exception of medical anatomy) and concentrate on natural history".<sup>52</sup> Other activities in which Jameson participated included attendance at the anatomy and surgery classes of John Bell (1763-1856), the elder brother of Charles (1774-1842), who was to become his lifelong friend and artist on his 1798 tour of the Western Isles of Scotland.

Jameson's other early influences included a tour to Ireland in 1797. On 17 June 1797, Jameson left Edinburgh for Arran and Ireland.<sup>53</sup> Although the Arran diaries contain extensive field notes, the Irish visit involved a number of meetings and visits to museums that had a profound effect on Jameson's geological thinking. During this visit Jameson visited the Leskean museum in Dublin, for which his diary entries show him to give very detailed descriptions. He met with George Mitchell (1766-1803),<sup>54</sup> had

---

<sup>50</sup> Most of the information here is in Sweet (1963), 81

<sup>51</sup> Correspondence between Jameson and Banks can be found in the Dawson-Turner collection, *BMNH*.

<sup>52</sup> Sweet (1963).

<sup>53</sup> EUSC Ms Dc.7.126. See also Sweet (1967).

<sup>54</sup> Sweet (1967), Appendix 1. Jameson, 112. George Mitchell was a good friend to Jameson in the short time that he knew him. Having first met on his Irish tour in 1797 Jameson had the greatest respect for him. Mitchell, despite having graduated from the University of Dublin in 1788 with a BA and in 1791 with an MB, had no official position in Dublin society. He was engaged in working on the Leskean collection from 1792 until 1798 where, presumably under the influence of the collection's chief instigator, Richard Kirwan, he entered as a student at the Bergakademie in Freiberg, a student of Werner. Kirwan proposed that a similar mining academy be set up in Dublin, and, in 1801 Mitchell, still at Freiberg, was proposed as a senior member. It is probably owing to the influence of his dear friend Mitchell that Jameson enrolled as a student in Freiberg in 1800. Their friendship was renewed there until Jameson had to return to Edinburgh in 1802 upon hearing of his father's illness. Mitchell also fell ill that year and never recovered. He died early in 1803.

meetings with Richard Kirwan (1733-1812)<sup>55</sup> and encountered numerous private collections. Jameson first landed in Ireland on June 25 1797: Geological matters were clearly on his mind:

Next morning about 12 o'clock landed upon the coast of Ireland upon Isl. of Magee. Here I saw great rocks of Limestone inclined at about 12° with immense quantities of flints. This runs in many cases amongst the whin.<sup>56</sup>

Similarly, on June 26 whilst travelling:

Having missed the mail to Newry we took tickets for the next day. Then walked about the town. After dinner walked about 3 miles out of town ascended a considerable height where I had the good fortune to observe the Kragg of Mr Kirwan, also Basalt with Zeolite & strata of White limestone (alongside the whin) having flints in it.<sup>57</sup>

On July 1 1797, Jameson took his first visit to the Leskean cabinet. He met George Mitchell, (1766-1803) (with whom he became great friends and who attended Werner's mining academy in 1801) who took him round for about one hour. In the evening, Jameson recalls having "a great deal of interesting conversation", mostly on mineralogical matters.

Jameson spent most of his time in Ireland immersed in mineralogical matters, visiting the Leskean almost everyday, except when he was in the field or busy observing geological features *in situ*, and dining in the evenings over mineralogical conversation with Mitchell and Kirwan.<sup>58</sup>

---

<sup>55</sup> Sweet (1967), 122. The influence on the young Jameson of Richard Kirwan (1733-1812) is paramount to a full understanding of Jameson's geological thinking. Kirwan was an Irishman who originally studied law in England and Germany. Whilst in England, Kirwan was received by the London literati. He became interested in chemistry, and, in 1782, was awarded the Copley Medal of the Royal Society. He published his *Elements of Mineralogy* in 1784. Kirwan became an active member of the Dublin Society and a founder member of the Royal Irish Academy of which he was President from 1799 until his death in 1812. Although never a student of Werner's, Kirwan, as someone who corresponded extensively with European scientists of the day, visited Werner and was very influenced by his work and theories. Kirwan's efforts enabled the purchase of the Leskean collection by raising funds from the Irish parliament. Kirwan's second edition of his *Mineralogy* was based largely upon this collection. For more information on Kirwan see DNB, Reilly, J & O'Flynn, McLaughlin P J (1939).

<sup>56</sup> EUSC Ms Dc.7.126 June 25 1797.

<sup>57</sup> EUSC Ms Dc.7.126 June 26 1797.

<sup>58</sup> *Irish Journal* (1797).

Jameson spent many days at the cabinets undertaking careful examination of the various collections. Mr Kirwan occasionally joined him for short periods to examine fractures but the person with whom he spent most time with was George Mitchell.<sup>59</sup>

Perhaps the highlight of his trip was his invitation to Kirwan's on July 10. Mitchell also attended. They were shown into Kirwan's laboratory that included bellows Kirwan had used in fusibility experiments. It was clear that, throughout his visit, Jameson was exposed to ideas that reflected Kirwan's disdain for Huttonian theory:

Mr Kirwan during his conversation mentioned several strong fails against the Huttonian theory. 1<sup>st</sup> that in the Rhine the stakes of a bridge built by the Romans was taken up, when the lower ends were found completely silicified. In a place in [?] where sandstone is cut, it is found that the part taken away is in a certain time renewed, by the accumulation of sand by the sea and the infiltration of siliceous matter. When granite decomposes he remarked, it forms a kind of sand but Gneiss by decomposition forms a kind of cement-like matter.<sup>60</sup>

Jameson respected and admired Kirwan's work and hospitality. Kirwan, in turn, showed a certain respect for the young mineralogist, allowing him to view private aspects of his collection:

Mr Kirwan's cabinet consisted of several sets of drawers but he had not got them arranged. Dr Mitchell told me he had never shown them before...<sup>61</sup>

And similarly when Jameson left to return to Scotland:

After taking leave of Mr Kirwan, who regretted that I should leave Dublin so soon I took leave of my worthy and amicable friend Dr Mitchell, whose attention and kindness shall never be erased from my mind as long as one spark of gratitude remains.<sup>62</sup>

It is during Jameson's time at Freiberg under Werner's tutelage that the most dramatic changes occurred in the former's scientific thinking. It is to an examination of this period that I shall now turn.

---

<sup>59</sup> EUSC Ms Dc.7.126 July 6 1797.

<sup>60</sup> EUSC Ms Dc.7.126 July 10 1797.

<sup>61</sup> EUSC Ms Dc.7.126 July 10 1797.

<sup>62</sup> EUSC MS Dc.7.126 July 10 1797.

### 1.4.1 The Legacy of Freiberg: Werner and the *Bergakademie*

Shortly after Jameson returned from Freiberg, Jameson's friend Johann Friedrich, Lampert wrote to him for the first time since their stay at the *Bergakademie*:

Never the happy days we spent in Freiberg together, shall come out of my memory and should we ever meet there again, by God, it would one of my happiest occurrences...I was very glad to see the bright effects of your staying in Freyberg and rejoiced very much with the freeness with which you defend these masterly themes of our masters theorie. It is true the more one thinks about it, the more beauties and proofs of the excellence of his systeme occur.<sup>63</sup>

Lampert's words suggest two things: firstly, that friendships were secured at Werner's mining school; and, secondly, that students there adopted a strong allegiance to the methodology of their tutor, Werner. Jameson's friends at the academy corresponded with him throughout his life. J. H. Vivian wrote in 1815 after an eight-month tour:

passing thro Dresden, I visited our old friends at Freyberg...I was induced thro' Werner's excessive kindness and attention to remain there upwards of six weeks...It gives me pleasure to add that our good friend [Werner] is in tolerable health and spirits and even mediates a visit to England in the ensuing summer.<sup>64</sup>

Despite evidence of a number of close and lasting friendships whilst in Saxony, little is known about Jameson's activities whilst he was a student there.<sup>65</sup> Although the journal Jameson presumably kept has never been found, there is enough evidence to suggest that the time he spent there was significant to his future endeavours especially with regard to his familiarisation with, and adoption of, the descriptive Baconian elements and theoretical concepts of Werner's geology.<sup>66</sup>

---

<sup>63</sup> EUSC Gen. 129. John Lampert to Jameson, 24 October 1802.

<sup>64</sup> EUSC Gen. 129. J. H. Vivian to Jameson, October 1815.

<sup>65</sup> No letters from Jameson to Werner survive in the Werner Nachlass. The probable social distance between Werner and Jameson may explain why "Werner did not know [in 1816] that Jameson spoke German": *Algorismus* 23 (1998): 163.

<sup>66</sup> It is assumed that Jameson did keep a journal whilst a student at the *Bergakademie* but to date, none has been found. The only manuscript material written by Jameson during this time are two volumes of notes of Werner's lectures housed in the National Museum of Scotland. The scripts, in German, have been transcribed by Ospovat. They are of the type compiled by amanuenses and sold to students. One volume is labelled 'Oryktognosie' and has notes in English and German in Jameson's handwriting. The second volume, also in German, principally deals with 'Geognosie' and includes a table of the structure of mountain rocks from which is derived the table in his own volume of Geognosy in 1808.

Jameson attended the Freiberg academy in 1800 where he was to remain for just under two years. His increasing interest in Werner's doctrines through his Ireland visit<sup>67</sup> led him to persuade his father to allow him to study at the mining academy.<sup>68</sup> There he not only attended lectures but also visited mines and travelled to examine geological features in the field. Some of his fellow students at Freiberg were prominent members of the European literati and included such people as his personal friend George Mitchell, Frederick Mohs (1773-1839), Heinrich Wilhelm Meuser and Henrick Steffens (1773-1845).

In February 1801, Jameson was awarded the certificate of proficiency in 'Oritognosie' (Mineralogy) and 'Geognosie' (Geology). This stay in Freiberg was cut short, however, and in 1802 he returned to Edinburgh on becoming aware of his father's failing health.<sup>69</sup> Jameson returned home with the intention of renewing his studies at a later date. In writing to his friend Heinrich Meuser he said:

There is nothing I desire so much as to visit Freyberg [sic]; and I seriously intend, on the very first opportunity, to visit Germany. At present I am so situated that I cannot undertake any journey for at least twelve months, after that period I hope to be able to pay a visit.<sup>70</sup>

Jameson never did return to Saxony. Instead he opted to remain in Edinburgh firstly in the role as assistant to the Rev Dr John Walker, whose health was also failing fast, then as Professor in Natural History where he was appointed in February 1804.

Now that I have 'set the scene' on Jameson and the cultural context, I will begin my examination of Jameson's early geology, paying particular attention to the 'situated' nature of his, and others' knowledge. I begin with an assessment of such debate in the newly-formed scientific societies.

---

<sup>67</sup> This interest probably grew as a result of his visit to Ireland in the summer of 1797. His friendship with George Mitchell was influential. See Sweet (1967b).

<sup>68</sup> Sweet and Waterston (1967).

<sup>69</sup> Jameson (1976).

<sup>70</sup> Jameson L (1854), 20.

# 2

## CONVERSATION: LEARNED SOCIETIES

### 2.1 Introduction

Any examination of Jameson's geology, its implications for understanding geological debate and its public promotion, should appropriately begin in the semi-public realm of scientific societies. Wood reveals the importance of studying societies as sites for natural knowledge production:

There are a number of related senses in which science can be said to have been made public during the 'long eighteenth century' in Britain. The first is that the validation of matters of fact or theory became a collective enterprise carried out most characteristically in the semi-public space of a learned academy, club or voluntary society, where carefully contrived experiments were displayed or reports read for communal consideration. In the Scottish Enlightenment, scientific matters were discussed in generalist groups...within these bodies men of science exchanged ideas amongst themselves and with non experts which meant that they were able to subject their own work to informed scrutiny and at the same time introduce others to the technicalities of scientific inquiry.<sup>1</sup>

Geology, unlike more established physical and chemical sciences, was still in its relative infancy. Yet it was to be discussed widely in societies between 1785 and 1820. The two societies in Edinburgh whose members were concerned mostly with geological conversation in Edinburgh were the Royal Society of Edinburgh (RSE) and the Wernerian Natural History Society. In this chapter, I will contrast the conduct of the RSE with Jameson's society, beginning by building on Shapin's analysis of the RSE up to and including its decline, showing how many of the goals, aims and methods held by its members differed markedly from Jameson's. I shall begin a study of these 'sites' by

---

<sup>1</sup> Wood (1994), 121.

discussing the *ways* in which the RSE formulated its public identity on a commitment to the tenets of Huttonian geology and how and why this form of natural knowledge was disseminated into the civic realm.

## 2.2 A Huttonian Fortress: The Royal Society of Edinburgh

Apart from being the most influential scientific society in late eighteenth-century Edinburgh, Shapin has argued that historical geology was allowed by the RSE to develop a 'theoretical' form in which the RSE's inception and the social conditions surrounding its development played a crucial role.<sup>2</sup> The rise of the Society, together with its 'earth science' component, is best seen as a complex network of interaction between Fellows that attended meetings and contributed to its *Transactions*. To understand the social framework so important to this advancement of earth science, one has first to refer to the action of precursor institutions.

The structure of societies that preceded the RSE created the necessary conditions in which natural knowledge was organised in late eighteenth-century Edinburgh.<sup>3</sup> These societies, most notably the Society of Scottish Antiquaries and the Philosophical Society, show their organisation to be manifest in a maturing relationship between the 'enterprise of natural knowledge' and 'institutional structure'.<sup>4</sup> The RSE was formulated on these grounds making way for the earth sciences in its specialised and theoretical form to develop.<sup>5</sup>

Before 1783, very little geological work was presented to any existing Edinburgh society.<sup>6</sup> The RSE's 'early period' immediately following its foundation remained virtually free of controversy:<sup>7</sup> the first paper read to the Society with theoretical leanings

---

<sup>2</sup> Shapin, (1971), *PhD*.

<sup>3</sup> Shapin (1971). Shapin specifically refers to a discussion of societies not connected with the RSE but those that preceded it, the most notable being the Society of Scottish Antiquaries.

<sup>4</sup> Shapin (1971), 80. For further studies of the Edinburgh Philosophical Society, see Emerson, (1974).

<sup>5</sup> See in particular Emerson (1974), (1979).

<sup>6</sup> Shapin (1971), 117 notes that the contents of the Philosophical Society's 'essays and observations' of both the Physical and Literary classes reveal none of a geological nature between 1754 and 1771

<sup>7</sup> Shapin (1971), 243.



being Hutton's *Theory of the Earth*.<sup>8</sup> It was three years later in 1788 with the first official publication of the Society's *Transactions* that Hutton's theory first reached a wider audience.<sup>9</sup>

Despite changing social and economic conditions, the social status of RSE Fellows remained very similar to predecessor societies, in being composed almost entirely of members from the professional and landed classes. Its foundation, the result of the outcome of intense controversy and demand for natural knowledge, led to a particular set of circumstances that gave rise to prominence of scientific activity - particularly geology and mineralogy:<sup>10</sup>

The fortuitousness of the circumstances which created the RSE as it was consists in it having no intrinsic relationship to what we may regard as the proper role of a scientific society in this period - the provision of a free and efficient forum for the presentation, criticism and dissemination of original ideas in natural knowledge.<sup>11</sup>

The community of geologists as 'products' of this elite landed status may have significantly aided geology's progress by bringing scholars together in a single forum where conversation became a possibility. The very 'coming into being' of the RSE, therefore, was crucial to the rise of the earth sciences in Edinburgh. Arguably, the creation of the necessary conditions for the promulgation of landed amateurs to discuss geological issues may have aided the creation of the overwhelming body of support for Hutton's theory.

Shapin identified the coming about of a Society identified with geological theory by creating a simplified model based on phases. These may be, broadly, broken down as the following. Phase one of geological development in the RSE occurred between 1783 and 1788. During these years, Hutton's theory was read first in 1785, delivered to close colleagues and read within the confines of the Society's meetings. This marked the first 'theoretical' disposition in favour of Hutton's work and was without formal opposition. The early years thus allowed for biased theoretical conversation amongst Fellows

---

<sup>8</sup> NLS MS ACC 10000/2. Minutes of the Physical Class, RSE, November 1783 - June 1793.

<sup>9</sup> Hutton (1788), 209.

<sup>10</sup> Campbell and Smellie (1983), 3-5.

<sup>11</sup> Shapin (1971), 129.

without opposition: time enough to formulate a coherent understanding of key concepts.

The second phase took place between 1788 and 1802. Here Shapin identified recognised signs of a growing awareness of Huttonian theory and the emergence of early formal opposition. This period is symbolised moreover not only by the appearance of formidable misgivings to Hutton's work but by such misgivings from within the RSE.

The third phase took place between 1802 and 1806. This marked the beginning of a 'formally' recognised opposition to Hutton. This period saw a comprehensive defence of Huttonian geology by the Society, manifest particularly in Playfair's *Illustrations* - in response to the official publication of John Murray's Wernerian *Comparative View*.<sup>12</sup> The RSE also faced the beginnings of opposition to the theory from an institutional setting, the University of Edinburgh, following the appointment of Robert Jameson to the chair of Natural History in 1804.

The fourth phase, 1807-1808, was where geological debate was seen to have taken place within 'the walls' of the Society itself. In 1808, no papers of a Wernerian persuasion were presented. What emerged instead, however, was a Huttonian stronghold.

The fifth phase, 1809-1815, saw a 'turning point in fortune'<sup>13</sup> for the Huttonians. Brought on by modifications of Hutton's theory (neo-Huttonianism) and the gathering and publication of new empirical evidence based upon travel, Huttonians enjoyed 'new confidence' in the merits of their theory and delivered evidence publicly at almost any opportunity. Dean has also commented on the mood in the Huttonian 'camp' at this time:

The fervour of the Huttonian-Wernerian controversy thus culminated between 1810 and 1813 in a series of publications favourable to some form of Huttonian belief...Despite this impressive predominance however, European opinion as a whole and the public in general failed to support the new outlook. The next tasks would therefore be to preserve as many of Hutton's concepts as possible, to find further confirmations of them and to convince the world of their validity.<sup>14</sup>

---

<sup>12</sup> Playfair, (1802).

<sup>13</sup> See chapter seven on the public response to Sir George Mackenzie's publication, *Travels in Iceland* (1811).

<sup>14</sup> Dean (1992), 161-2.

Dean fails to address why the Edinburgh situation was so unique from the rest of Europe. I argue in chapters six and seven that this ‘new Huttonian mood’ was primarily brought about by Sir George Mackenzie’s corroboratory evidence brought back from Iceland which, initially, remained localised to Edinburgh circles.

The new dominance experienced by Huttonian members of the RSE did not reduce the ferment of geological activity there. On the contrary, geological debate became more frequent and ill-natured after 1808, owing more, as I argue in chapter four, to do with proprietary concerns. Thus, controversy and the stirring of Huttonian action was not borne out of a desire to promote Huttonian geological theory *per se*, so much as a right to display their property publicly in their own premises.

Ironically, a gradual period of decline in geological interests occurred when the Huttonian faction assumed dominance in the affairs of the RSE. During these years (most notably, 1815-1818), there was less need for geological debate in Edinburgh, since the Huttonians had already presented significant and valuable evidence against Wernerian theory and had acquired by Charter the right to display property of their own. Against this background of Shapin’s work tracing Huttonian geology’s rise and evolution as the RSE nurtured it, I shall discuss *how* these specific events led to change and why the RSE’s public identity as a Huttonian Society was so important in civic culture.

### 2.2.1 Control: Huttonian Geology and the RSE

The RSE’s awareness of official opposition to Hutton’s ideas derived from the publication of Kirwan’s 1793 paper entitled “*Examination of the supposed Igneous Origin of Stony Substances.*”<sup>15</sup> Kirwan was elected Fellow on 27 June 1796.<sup>16</sup> Although he never read a paper at any RSE meeting, or published in its *Transactions*, Kirwan remained a Fellow of the Physical Class until his death in 1812.<sup>17</sup> London and Dublin were the places where most of his views became known, particularly the Royal Society of

---

<sup>15</sup> Kirwan (1793), 51-87. The paper received its first reading February 3, 1793.

<sup>16</sup> Shapin, (1971a).

<sup>17</sup> NLS MS ACC 10000/4 Minutes of the Physical Class, RSE, 1793-1824.

London, where he was a favoured member and friend of Sir Joseph Banks. He was also a Fellow of the Royal Irish Academy.<sup>18</sup>

Kirwan's attack on Hutton ended 'geological harmony' in the RSE. Hutton devoted an entire chapter in his (1795) paper counteracting the claims of Kirwan. Chapter two was entitled '*An examination of Mr Kirwan's objections to the Igneous Origin of Stony substances*' where all of Kirwan's objections were addressed in detail.<sup>19</sup>

Kirwan made scathing remarks against John Playfair. Given Hutton's somewhat clumsy writing style, his theory was made public by Playfair (1802) in modified form, which allowed greater ease of comprehension and a potentially greater public acceptance. Kirwan's attack on Playfair in 1802, together with John Murray's '*Comparative view of the Huttonian and Neptunian systems of Geology*',<sup>20</sup> a critique of the Huttonian system in favour of Wernerian ideas, resulted in a prompt pro-Huttonian response in the '*Illustrations*' specifically to counter these claims.

Murray's *Comparative Review* was essentially an English summary of Werner's theory<sup>21</sup> - a serious attempt to put the theory within the reach of public knowledge in Edinburgh. With a greater number of emerging journals, the 'sense' of competition and urgency in 1802 went beyond the mere level of 'awareness', and, for the first time witnessed an 'encroachment' from outside institutions. The rise of a politically active periodical press, coupled with more widespread journal publication and general dissemination of information at the start of the nineteenth century, would also have aided outside appreciation or denial of ideas spreading from the RSE.

By 1802 opposition to Hutton also came from *within* the walls of the RSE.<sup>22</sup> Shapin described the situation: "Playfair as professor of mathematics exerted his

---

<sup>18</sup> Kirwan published widely throughout his life on a number of scientific issues. His geological manifestations presented the most formidable challenge to the views of James Hutton in the late eighteenth-century. For a full list of his works see *DSB*, 389-390.

<sup>19</sup> Hutton (1795), Chapter Two.

<sup>20</sup> Murray (1802).

<sup>21</sup> Davies (1969), 147.

<sup>22</sup> NLS MS ACC 10000/4. Kirwan was elected Fellow of the RSE in 1796.

influence in favour of Huttonian theory within the Society. The Society developed an identity via the fruitfulness of an earth science tradition that developed in its midst”.<sup>23</sup>

In the first few years of the nineteenth century, it was chiefly Kirwan who continued to oppose Huttonian writing: Playfair seeing Jameson merely as little more than an ‘aggravating nuisance’.<sup>24</sup> However, Jameson’s appointment as Professor of Natural History in 1804 strengthened the Wernerian position through institutional means. Jameson had a stronger platform to counter or ‘resist’ Huttonian measures. I shall reveal that he did not often use his position for the specific purpose of fighting a Wernerian cause. It was not until 1807 that a significant Wernerian challenge by Jameson occurred at an RSE meeting in February.

In 1807 the Wernerian faction dominated meetings of the Physical Class, with Robert Jameson, Thomas Macknight and Thomas Thomson proposing or reading something at almost every gathering. According to the minutes, meetings were so lengthy that they often overlapped into vacant meeting times for the literary class.<sup>25</sup> Sir James Hall, John Playfair, and Thomas Allan launched counter attacks to these Wernerian papers throughout the latter part of 1807 and 1808.<sup>26</sup>

One such encounter involved Sir James Hall and Thomas Thomson, then a Wernerian and co-founder of the Wernerian Natural History Society. In a paper given to the RSE on 20 April 1807, Hall challenged Thomson’s *Sketch of the Geognosy of Werner*<sup>27</sup> by writing two responses counteracting points Thomson made about granite:

In several conversations I have had with Mr Jameson and Dr Thomson I have never been able to enter clearly into the views with respect to newer granite upon which one of the most material points of the controversy turns. If I have not mistaken their meaning these Gentlemen consider

---

<sup>23</sup> Shapin (1971), 244.

<sup>24</sup> Dean (1992), 108.

<sup>25</sup> Shapin (1971), 246.

<sup>26</sup> NLS MS ACC 10000/4. Society meetings in 1807 saw almost all papers on geological topics given by Wernerian Fellows. Only the last two meetings in November and December do not carry any contribution from Jameson, Macknight or Thomson. In contrast, in 1808 there were no papers given by Wernerians at all.

<sup>27</sup> NLS MS ACC 10000/4.

newer Granite along with sienite and newer porphyry an overlaying primitive formation on the tops of the gneiss, mica slate and the clay slate.<sup>28</sup>

Hall's disapproval of Thomson's delivery is more than apparent in a letter addressed to John Playfair on April 23 claiming that Thomson had not produced sufficient proof, so important to a Huttonian, to substantiate claims:

In the paper read by Dr Thomson in the Royal Society on the 6<sup>th</sup> of this month under the title of a 'Sketch of the Wernerian theory' the author laid down various important propositions in geology which he affirmed to be true without advancing any arguments in support of them; but declared that he was perfectly ready to produce the documents by means of their truth ascertained. We cannot then look upon his paper as containing more than the enunciation of these propositions. As I am particularly interested in this topic and as I cannot help entertaining great doubts as to the validity of several of these propositions I was induced at last meeting of the society to request that Dr Thomson would perform what he had undertaken to produce his proofs. I put into his hands a piece of paper containing what I wished and now I send you a duplicate of that paper to remain with you as secretary for the inspection of the members of the society. I trust that Dr Thomson will not hesitate in depositing his proofs in the same manner and for the same purpose.<sup>29</sup>

Thomson's response to Hall's critique cannot be found. The minutes reveal Thomson replying at a meeting on May 4: "Dr Thomson read a paper containing replies to certain questions posed by Sir James Hall respecting some points of the Geognosy of Werner".<sup>30</sup> Hall, the more militant party, once again prompted for debate on the issue by reading geological questions to the meeting of 6 February 1809 specifically addressed to Thomson. These went without reciprocation: Thomson did not read another paper in the RSE until November 1810.<sup>31</sup>

Intellectual bombardments of a similar nature from Huttonians, based on verificationary criteria, may have contributed to a 'shift' in the affairs of the Society by 1808. A change occurred in meetings of the RSE whereby all activity of Wernerians ceased. It is unclear when or why this occurred except that Jameson's own Society was formed in January of that year. Wernerians seem to have withdrawn from conversing at the RSE's meetings altogether, perhaps because the nature of debate based on theoretical notions through hypothesis testing and verificationary means, was not

<sup>28</sup> NLS MS ACC 10000/351. Royal Society of Edinburgh files - '*Sir James Hall's challenge to the Wernerians*' 1807. The file contains three detailed responses to a paper of Thomas Thomson, delivered to the Royal Society two weeks before. It was mostly concerning specific details on the question of Granite. There is also a letter addressed to Professor Playfair dated April 23 1807.

<sup>29</sup> NLS MS ACC 10000/351. Sir James Hall to Professor Playfair, April 23, 1807.

<sup>30</sup> NLS MS ACC 10000/4.

methodologically acceptable. The minutes do not reveal whether Wernerians continued to be present in a silent capacity in the RSE or whether silence and/or boycott occurred for political reasons, as a form of protest at a Committee electoral system specifically designed to oust them from high ranking positions within the Society.<sup>32</sup>

The founding of the Wernerian Natural History Society in January 1808 remains the single most plausible explanation for Wernerian silence in the RSE. Jameson had created his own forum that was - in its early stages at least - oriented to mineralogy and the earth sciences. I argue, however, that the Wernerian Society was only founded as an 'alternative' to the RSE based on methodological and proprietary disagreements, and not specifically, as some have suggested, for the sole reason of opposition over geological theory. For the first time, Wernerian views could be identified within a recognised establishment but as I shall show, most of the WNHS meetings concentrated on matters of an empirical nature. Thus, a more plausible explanation for separation may have been because RSE meetings were becoming *too* dominated and controlled by members obsessed with Huttonian theory.

As Shapin has shown, the RSE became more Huttonian in character between 1809 and 1812. Geological communications up to 1815 continued to dominate the meetings of the Society, leaving no doubt that a loss of discursive interaction with the Wernerians from within the Society's walls had not led to a demise of civic interest in the topic. Wernerians were present at meetings but did not make contributions.<sup>33</sup>

Further evidence of the proprietary and methodological nature of this separation occurred in 1811 when Sir James Hall submitted a proposal to initiate a sub-committee specifically for the discussion of geological affairs, particularly concerned with the surrounding Edinburgh area. At the next meeting, on May 20 1811, the proposal received further consideration:

---

<sup>31</sup> NLS MS ACC 10000/4.

<sup>32</sup> NLS MS ACC 10000/4. The minutes show that it was not until November 5 1810 that a Wernerian member read another paper at RSE meetings. This was a contribution on the analysis of a new mineral by Thomas Thomson.

<sup>33</sup> NLS MS ACC 10000/4. See chapter seven for Henry Holland's testimony of Wernerian silence in the face of Sir George Mackenzie's paper on *Travels in Iceland*, given in 1811.

The meeting then took into consideration the proposal made by Sir James Hall which had been described at the two previous meetings that a standing geological committee may be appointed the object of which shall be to examine such geological facts as may occur particularly in the neighbourhood of Edinburgh and report upon them to the society. Sir James Hall assigned as principle notice for this measure the transient nature of many such facts which are brought into view by the working [?] the making of roads, the digging of foundations and which in the course of a very short time, perhaps a few days are again lost or destroyed by the further progress of the same works. He likewise held out an expectation that by the assertions of the proposed committee a multitude of facts, not of sufficient consequence singly to rise to matter might be concentrated in such a manner as to lead to important consequences. The society after considerable description agreed unanimously to this proposal and appointed the following gentlemen members of the geological committee; Sir James Hall (chair), Sir George Stewart Mackenzie, Lord Webb Seymour, Lord Meadowbank, Mr Clerk, Colonel Imrie, Mr Playfair, Dr Home, Dr Hope, Mr Allan, Mr Jameson, Dr Thomson, Dr Macknight. The society at the same time empowered and constructed a committee to divide themselves into such sub-committee's as they should think best calculated to promote the object of the appointment. The sub-committee's shall draw up separate reports and all of them shall be published in the transactions if they shall be approved of.<sup>34</sup>

It is not clear what the committee were trying to achieve, whether their interests were practical and utilitarian or theoretical in nature. Entries in the minutes suggest both. The primary objective was initially practical: a fact-gathering exercise to derive information from new exposures and outcrops before they became inaccessible given the fear that there was a threat posed to Salisbury Crags from mining. Preservation of the site may, however, have had theoretical ramifications since it was a resource that Huttonians – and, to a lesser extent, Wernerians – used to provide evidence in favour of their theoretical views.<sup>35</sup> Hall's suggestion for the Committee to divide itself up into Sub-Committees each to draw up separate reports, may have occurred on theoretical grounds, given that members of the Wernerian party were all placed in one Sub-Committee.

After 1815 geological papers continued to be read at meetings. Less geological papers were read to Society meetings, falling from 56% to just 1% of those read by 1818.<sup>36</sup> This was the result of three major factors. Firstly, corroboratory evidence in favour of Hutton's theory had been accumulated. Secondly, the RSE gained some control under a new Charter, to display its own property except material in Robert Jameson's possession.<sup>37</sup> Third, new Fellows in the Society took an active social role in

---

<sup>34</sup> NLS MS ACC 10000/4.

<sup>35</sup> Shapin (1971), 281.

<sup>36</sup> Shapin (1971), 60.

<sup>37</sup> See discussion in Chapter Four.



its affairs without possessing a passion for geology, David Brewster being the most dominant of such figures.<sup>38</sup>

As an institution for the discussion and furtherance of scientific knowledge, the RSE contributed heavily to the high profile of geology in civic culture, increasing in popularity as theoretical and speculative science captured the public imagination. By the early nineteenth century, the RSE had become theoretical and Huttonian. Its dominant members had tried to oust Wernerian views and Wernerian scholars from its ranks.

In contrast, Jameson's Society had very different goals and scientific objectives. Understanding the reasons for its inception throws new light on an understanding of why Jameson formulated it, not necessarily for theoretical rivalry, but on methodological and political grounds. Jameson, as a Baconian, would not have been happy with the RSE's theoretical bent. He would also have been unhappy about the overall control Huttonians had accumulated over the direction of the RSE's scientific affairs for proprietary reasons.

Jameson recognised that the RSE was publicly labelled as a Huttonian society and had become dominated by members in committee positions who publicly promoted that view through non-Baconian methods of enquiry. A study of the Wernerian Society will show that many of its aims, goals and methods differed markedly, and will offer an understanding of the precise intellectual nature of Jameson's Wernerianism and mode of enquiry.

## 2.3 The Wernerian Natural History Society

Unlike most nineteenth-century learned Edinburgh societies,<sup>39</sup> Jameson's Wernerian Natural History Society has not hitherto been the subject of any systematic historical examination.<sup>40</sup> I shall demonstrate that an examination of the inception, operations and

---

<sup>38</sup> David Brewster (1781-1868).

<sup>39</sup> For works on other Edinburgh learned Societies, see McElroy (1979). For papers on societies that preceded the RSE and the WNHS see Emerson (1979), (1988a), (1988b). See also Shapin (1974) and Bell (ed.), (1981).

<sup>40</sup> The only paper to have been written about the *WNHS* is Sweet (1967a). This short account gives a descriptive overview of the society and its founding members but amounts to little more than copies of the *Memoirs* and Minutes with near to four pages devoted to lists of foreign members. The paper serves as

conduct of members adds considerably to an understanding that not all societies operated with the same driving force or methodological principles as the RSE. For these reasons, I argue that the Wernerian Society was not a 'break-away' group from the RSE, despite Wernerian grievances toward the RSE. Jameson himself was primarily responsible for the inception of the WNHS:

Professor Jameson (who may be considered the founder of mineralogical science in Great Britain) had completed the object of this sketch soon after his return from Germany; and as public attention had been strongly solicited by his valuable works, to one department of natural history it was considered a favourable opportunity to bring together, in an organised form, such individuals as were desirous of extending the bounds of our natural knowledge in general without limiting the tendencies of its original founders.<sup>41</sup>

Porter described the inception of Jameson's Society as having arisen or seceded from a 'general parent' – in this case, the RSE. Many Fellows of the RSE also joined the WNHS, but it is important to note that they did not relinquish their RSE membership or cease to attend meetings of other societies. They became active members of both or more, co-existing side-by-side.

Porter describes the WNHS as having been founded "on a collective loyalty to Werner's 'geognostical' system under the direction of Jameson".<sup>42</sup> While this can be said to contain some truth, concerns about geological theory did not dominate Wernerian Society meetings in the same way that they did in the RSE. Porter claims that Jameson first founded the Society to promote Wernerian theory in contrast to the GSL. I show that this was not the most important factor for its inception. On the contrary, instead of Jameson's aims being different to the GSL, I argue that he founded it on the similar principles of that shared commitment to co-operative, empirical, non-theoretical science, deemed lacking in the RSE.<sup>43</sup>

As sole president, Jameson's command over the activities of the Society was significant, especially in the early years. Geological topics were discussed regularly. Most

---

a useful starting point for any analytical study. Dean (1992), 149-52, offers a short descriptive account of the Society, only in the context of the Hutton-Werner debate. Dean gave a short list of the Society's honorary members, English and international, the date of its inception and outlined the contribution of Jameson to his own society. Porter (1977), 148-9, also gives a brief exposition with some analysis of the Society.

<sup>41</sup> *Blackwood's Magazine* June, (1817), Vol.1 No. III. 232.

<sup>42</sup> Porter (1977), 149.

of them Jameson either read or published himself. Jameson was, however, but one member and I shall show that very few members were strict adherents to the ‘geognostical’ system of Werner. Papers were published on a range of topics with geology only ever taking centre stage in the Society’s early years. The Society’s *Memoirs* and minutes show indeed that, overall, little was published on topics concerning, or making direct inferences about, Wernerian theory.

Papers on all branches of natural history were read in the early part of the nineteenth-century, including geological and mineralogical topics, those related to chemistry, physics, botany, zoology, comparative anatomy, and entomology. Although not an absolute reflection of what was discussed, the Society published many papers that were read and discussed at meetings. This claim is best shown by examination of its *Memoirs*.

### 2.3.1 The Wernerian Society’s *Memoirs*

Publications in the Society’s *Memoirs* reveal a very similar pattern to papers read at meetings. Although many topics that were read were never published, most subjects were covered in the *Memoirs*’ eight volumes published between 1810 and 1839.<sup>44</sup> With over 200 papers ranging from physics/optics and chemistry to the nature of Shetland sheep to Polar adventures, the Society’s earlier publications also showed a commitment to geology (including empirical studies and mineralogy) and natural history (topics from fishes to insects and domestic cattle to plants and meteorology).

Porter’s claim that the ‘Wernerian Society’s unity lay in loyalty to the geognostical system of Werner’<sup>45</sup> carries validity in the early context of the Society. A distinction has to be made, however, about Wernerian methods and Wernerian theory. Most geological papers did not contain information about the merits of Werner’s theory despite use of its terminology.

---

<sup>43</sup> Porter (1977), 148.

<sup>44</sup> After 1839 proceedings and abstracts of papers read were published in the *Edinburgh New Philosophical Journal* which was also solely edited by Jameson.

<sup>45</sup> Porter (1977), 149.

Papers with Wernerian leanings appeared mostly in the first volume. Jameson wrote on 'Cotemporaneous Veins' [sic.] together with six other papers, all, except one, on geological topics.<sup>46</sup> Jameson talked on veins and maps, and in both used Wernerian terminology for description of strata formation. Others, too, wrote powerful pieces that denoted a Wernerian theoretical slant. Thomas Macknight wrote 'On the mineralogy and Local Scenery of Certain Districts of the Highlands'<sup>47</sup> making no secret of his views concerning Werner, but supporting it as a system that purported to put fact over theory, a system that 'described' the mineral Kingdom rather than speculated:

I am now to lay before the society the results of my observations. In doing this I can hardly flatter myself that what is to be offered, will add much to the stock of knowledge in geognosy which has already been acquired...what importance may be attached to any information which I am able to communicate, it is not for me to decide. Thus much at least, it will however establish, if the clearest testimony of the senses can be at all be trusted that the mode of describing the mineral kingdom adopted by Werner and his school is not all together so full of theory, so unsupported by fact, and so remote from experience as has been alleged.<sup>48</sup>

Here Macknight emphasised reliability on sensory qualities and the external appearance of minerals advocated by Werner in his mineralogical system, not supposition which was viewed by Macknight as poor science. Macknight continued to make what was his most 'theoretical' point and in doing so made clear to the Society that he hoped that the reference to theory would not cause offence:

One remark more will not I hope be unacceptable in the society. It relates to the satisfaction in surveying a country afforded by the principles of geognosy. Compared indeed with every other mode hitherto proposed of viewing a mineral mass of the earth, the superiority of Werner's system can hardly, I think be appreciated in its full value.<sup>49</sup>

Although Wernerian language was used, most geological papers addressed empirical non-theoretical concerns. This was more apparent by the 1830s with the increasing demise of the Wernerian system. Archibald Geikie also, pointed out that items released

---

<sup>46</sup> *MWNHS* (1811), Vol. 1 – Jameson wrote seven papers in the volume six of which were geological. First *On Cotemporaneous veins*, 1-8, *On Mineralogical Queries*, 107-126, *On Geognostical maps*, 149-162, *On The Topaz of Scotland*, 445-453, *On the Strontian-Lead glance formation*, 461-465 and *On Cryolite*, 465-469. Papers on geology were not just written by Jameson. The longest was by Thomas Macknight *On the mineralogy and scenery of certain districts in the Highlands*, 274 -370. Of the total number of thirty-four papers published in volume one, fifteen were related to geology and mineralogy.

<sup>47</sup> *MWNHS* Vol. 1. (1811), 274-370. First read 13 Jan 1810.

<sup>48</sup> Macknight (1811), 276.

<sup>49</sup> Macknight (1811), 293.

in the *Memoirs* did not necessarily follow the Wernerian theory. Moreover, the opening advertisement of the *Memoirs* suggests that, in theory at least, there was not an open policy to demonstrate partisanship:

In laying its memoirs before the public, the society does not hold itself as responsible for the facts or opinions which may be advanced on the various topics of natural history that are discussed. These accordingly, must be distinctly understood as resting entirely on the individual authority of the respective writers who have favoured the society with communications.<sup>50</sup>

Based on the total number of entries for topics up to and including 1839, geology was not discussed widely as a percentage of the total number of papers published, declining broadly in line with the demise of geology's interest in the RSE after 1815.

Between 1808 and 1811, there were fifteen papers published on geological and mineralogical topics in the *Memoirs* from thirty-four papers in total. Between 1811 and 1816, thirty-five papers were published, sixteen geological. Then a dramatic decline began. Between 1818 and 1822, fifty-eight papers were published of which only eleven were geological, and, between 1823 and 1839, only five more geological papers appeared in the *Memoirs*. In its first sixteen years, the Society's list of geological papers accounted for nearly 50% of all those read. Between 1817 and 1822 they accounted for only 18% and from 1824 to 1839 when the *Memoirs* ended, geological papers accounted for only 8% of the total.

Jameson's dominance over the Society's publications also waned considerably between 1817 and 1839. In volume one of the *Memoirs*, nine of the thirty-four papers (26%) were read and published by Jameson. Between 1811 and 1816 he wrote five out of thirty-five (14%), and between 1817 and 1820 published only three more papers in total (7%). Of the seventeen papers Jameson put in the *Memoirs*, fifteen were mineralogical and geological and were all included in the first three volumes. No more appeared by him in the remaining five volumes, despite his continued presidency and untiring appearance at meetings. Most of these geological and mineralogical papers used Wernerian language, but not all were necessarily concerned to advance a Wernerian

---

<sup>50</sup> *Memoirs of the Wernerian Natural History Society*, opening advertisement.

theoretical position. Where they did, attention was focussed on the use of inductive logic in contrast to Huttonian counterparts' deductive reasoning.

The Society's publications appear not to support a notion of either theoretical or geological dominance in their affairs. Where geology was a topic of consideration, reference to Wernerian theory was mentioned but did not dominate proceedings: most references to Werner denoting the factual or descriptive elements of his philosophy.

The publications and readings of the Wernerian Society do not point to an explanation of its emergence as attributable solely to an intention to challenge the advocates of Huttonian theory in the RSE. On the contrary, it would appear that Jameson wished to form a Society that could refrain from reliance on theory, and advance one based on a philosophy of hypothesis and speculation as forms of scientific explanation.

The Wernerian Society operated mostly in a different 'intellectual context', adhering to Baconian principles of factual description. Together with factors of a proprietary nature concerning Society artefacts, the most likely explanation for the Wernerian Society's coming into being seem to be political and intellectual, not based on rivalry over geological theory. This argument may be supported by consideration of its members.

### 2.3.2 The Society's Members

Unlike Shapin's observation of the long-established landed structure of the RSE, Porter suggested that the Wernerian Society appealed "to many Scotsmen who did not have time, money or leisure for such thorough involvement in geological inquiry".<sup>51</sup> This was then, not, a Society made of up of those who could make natural history a lifelong pursuit. Many of the *resident* members<sup>52</sup> were from the professional classes, treating geology as a part-time hobby. Some members were relatively junior and often associated with Jameson's natural history class at the University.

---

<sup>51</sup> Porter (1977), 149.

<sup>52</sup> I consider *resident* members (those that were addressed in the Edinburgh area) as the most active in the affairs of the Society. Many honorary and foreign members were highly distinguished operatives in science and would have fallen within the category of independently wealthy natural philosopher.

The founding members of the Society, along with Jameson, came from a variety of backgrounds and occupations, none of which made a career from examining the natural history of geology. They were William Wright M.D., F.R.S. (1735-1836), physician and botanist; the Rev Thomas Macknight, D.D. (1762-1836), lecturer; John Barclay M.D. (1758-1826), anatomist; Thomas Thomson M.D., F.R.S. (1773-1852), chemist; Col. Stewart Murray Fullerton, of Fullerton Ayrshire, Charles Anderson, M.D. F.R.C.S.E (1793-1855) surgeon in Leith; Patrick Walker of Coates, (?-1837), advocate; and Patrick Neill, A.M. (1776-1851), naturalist and publisher.<sup>53</sup>

There were also many well known and distinguished honorary members of the Society including Sir Joseph Banks, Humphry Davy, George Bellas Greenough, James Watt, William Jackson Hooker, Charles Bell, William Scoresby, William Bullock, Samuel Hibbert, and William Parry. The international reputation of the Society was upheld by a very honorable list of foreign members and, apart from its first, Werner himself and Richard Kirwan, other members with a high reputation in science were Leopold von Buch, Alexander von Humboldt, J F. d'Aubuisson, Louis de Saussure, Jean Andre Deluc, J F. Blumenbach, Scipione Breislak, Alexandre Brongniart, Georges Cuvier, B. Faujas de St. Fond, Jean Baptiste Lamarck, Marc Auguste Pictet, Ami Boué, Etienne Geoffroy Saint-Hilaire and Louis Dufresne.

The Society's only president, Jameson, whilst never challenged, did not have as much control over the affairs of the Society as has commonly been assumed, despite the work of devotees like Thomas Macknight, Thomas Thomson and John Barclay in the early years. Macknight himself did not include statements of outright adherence as an 1817 paper on *Mineralogical notices and observations*<sup>54</sup> demonstrates, a paper which contrasts with his paper in volume one six years before.<sup>55</sup> Papers concerned with 'geognosy' continued to be read until 1824 when thereafter they rarely even ascribed to Wernerian terminology apart from some of Jameson's younger students, most notably Ami Boué, a

---

<sup>53</sup> More biographical information on the founding members is in Sweet (1967b).

<sup>54</sup> Macknight (1817), on 'Mineralogical notices and observations', *Mems WNHs*, Vol. 3, 104-122.

<sup>55</sup> Macknight (1811).

resident member from 1814-1818 who continued to write Wernerian papers into the 1830s.<sup>56</sup>

Apart from the years immediately following the Society's inception, Jameson's control was not as strong and as free of acrimony as is portrayed by others.<sup>57</sup> Many of Jameson's closest friends and associates disagreed with him, even on the validity of the Wernerian theory. In January 1816 whilst spending time in London and influenced by members of the Geological Society, Thomas Thomson, Fellow and co-founder of the Society, wrote to Jameson, expressing his desire to abandon the Wernerian theory altogether, urging Jameson to do the same:

The more closely I consider the subject of geology the less I am satisfied with the Wernerian arrangement nor have I the least doubt that it must be entirely abandoned. Werner will always be entitled to great praise for having first reduced this subject to order. But we have not evidence at all of for many of his positions. Thus it is said that granite is the lowest rock of all. I see no proof of this; abundance of other rocks are found under it every day. I think a good deal will be found from petrifications when they are once studied with precision and when we know in what particular formations each petrification occurs. The place of coal [also] has been plainly mistaken by Werner.<sup>58</sup>

The following year Thomson again made 'anti-Wernerian' remarks to Jameson:

In going over my mineralogy, I have been struck very forcibly with the vague manner in which Werner constitutes his species. His views on this important point seem to be radically defective...By this time I suppose you have begun your geological volume. I hope you will keep all theory out of it and stick entirely to matters of fact.<sup>59</sup>

And again whilst on a journey in Stirling in August 1817:

The weather has been so rainy since I came to Stirling and I have been so much employed with the concerns of eating and drinking that I have had no time left for geologising [sic.]. I examined the touch hills superficially. The one at the base, of which the mansion house of Touch stands, consists of a base of basalt with numerous crystals of feldspar. It is therefore a basalt porphyry. A very beautiful rock which I had not had the opportunity of seeing before. A Wernerian would probably call it a Green porphyry; but the name I have given is the true one.<sup>60</sup>

---

<sup>56</sup> EUSC Gen. 1996-9. Ami Boué (1794-1881). Boué studied under Jameson from 1814. He was so influenced by Jameson that he devoted his career to geology instead of medicine.

<sup>57</sup> Porter (1977), 149. Porter's account portrayed the WNHS as 'decaying or pulsing in line with Jameson's own interests and Wernerian geognosy'.

<sup>58</sup> EUSC Gen. 1999. Thomas Thomson to Robert Jameson, 1 Queens Sq, London, 30 January, 1816.

<sup>59</sup> EUSC Gen. 1999. Thomas Thomson to Robert Jameson, 1 Queens Sq, London, 30 May, 1817.

<sup>60</sup> EUSC Gen. 1999. Thomas Thomson to Robert Jameson, Stirling, 31 August, 1817.



Society members cast further doubts about Wernerian claims when Jameson's close friend John Forbes visited Cornwall in July 1818.<sup>61</sup> He complained of not being able to find anything in the Cornish granites that would render them stratified in accordance with Werner's system:

I am going to write you geologically, I know too well your devotion to that science to feel any apprehension that my letter will be deemed unwelcome...In many parts of this district the granite exhibits appearances very like stratification which has been considered as such by de Luc and some of the geologists of our school; yet from all I have yet seen, I am led to think it is not so in reality: at least I am certain that the main body of the granite is not stratified in this district...at one time I indeed had an idea that the granite really assumed the stratified character on its surface as if the cause which determined the stratified character of the inferiorcumbent [?] rock had begun to operate before the final close of the deposition of the granite. But I was forced to give up this idea upon finding no instance of this stratified appearance of ye. Gr on the different parts of the coast where the junction of their two rocks could be beautifully seen...you will find some imperfect notice of them in our Vol. Of transactions which has just been published. This book is much better than I expected yet you will readily in almost every geol. paper discover the glove and foot of ignorance and want of systematic principles. If you would see it (I have directed a copy to be sent to the Wern. Soc.) I w.d like much to learn your real opinion of it and what the world is likely to think of it.<sup>62</sup>

One of the early members of the Wernerian Society, George Bellas Greenough (1778-1855), first president of the Geological Society of London and member of the Wernerian Society from 1811, questioned the merits of the Wernerian system as early as 1812. An aspect of the Wernerian theory that Greenough had not correctly understood through field investigation was posed to Jameson in a letter:

Will you excuse the liberty I take in requesting you at your leisure to give a little insight into a very important part of the Wernerian theory which I have never correctly understood, I mean the gradual diminution of the waters of our globe as proved by the successive lowering of the outgoings of the different rocks. Surely it is not a general rule that the greatest heights are composed of the oldest substances. In England, Ireland and Wales neither Granit [sic.] Gneiss or Mica-slate are found at any considerable elevation, nor do they appear at the summit of Ben Nevis...if I mistake not the highest parts of the Pyrenees are limestone. Upon what observations does Werner found his opinion?<sup>63</sup>

Greenough is a perfect example of a society member who questioned many aspects of Wernerian theory and even did not have a high opinion of Werner's talents as a geologist. On a tour to Germany in 1816, he wrote to Jameson from Breslau: "From

<sup>61</sup> John Forbes was a relative of James Forbes (1809-1868). Biographical details of the younger Forbes are in Cunningham (1990).

<sup>62</sup> EUSC Gen.1999. John Forbes to Robert Jameson, Penzance, July, 13 1818.

<sup>63</sup> EUSC Gen.1999. George Bellas Greenough to Robert Jameson, Parliament Street, London 8 Dec 1812. Twenty-eight letters from Jameson to Greenough are housed at University College, London.

Werner we received the most marked attentions. If he is not the ablest of geologists he may fairly lay claim to being the most polite".<sup>64</sup>

Other members of the Wernerian Society were Jameson's pupils or ex-pupils and friends.<sup>65</sup> By the end of 1811, three years after its inception, the Society had three honorary members, one hundred foreign members, seventy-nine non-resident members and forty-three who were resident. The highest rise in membership occurred in the Society's early years. Between 1812 and 1817, only twenty-two resident, twenty-six non-resident and fifty foreign members were elected. From 1818 to 1823 membership increased, but, such numbers were essentially of a different type, less concerned with geology and the Wernerian system.<sup>66</sup> After 1824, a decline in membership began with very few new members being elected (sometimes fewer than ten a year). When the Society officially dissolved, there were only twenty-seven resident members, ten non-residents, and only three foreign members.

Amongst the most active and well-known members in the early years of the Society were Jameson's co-founding members, particularly the Glasgow chemist Thomas Thomson.<sup>67</sup> Their presence was more important in the running of the Society's affairs and in influencing the future direction of its intellectual vigour once the idea of Jameson as wholly dominant in the affairs of the society had been relinquished. I have suggested that some of the nature and opinions of the Society members showed Wernerian theory to be either not included or abandoned altogether. In any comparison with the RSE, the Society's public profile was also indicative of the kind of science to which it committed itself: a science that did not rely heavily on the methods of hypothesis or analogy, and was not specialised in its outlook.

---

<sup>64</sup> EUSC Gen.1999. George Bellas Greenough to Robert Jameson, Breslau, Germany, May, 1816.

<sup>65</sup> For detailed listings of members resident, honorary and foreign see *Minutes of the Wernerian Natural History Society* in 2 Vols. (1808-1858), EUSC Dc.2.55-56. See also Sweet (1967b).

<sup>66</sup> The best evidence for this reduction comes from an examination of the minutes and the volumes of the Society's memoirs and from personal correspondence to Jameson from other society members expressing grave reservations on key issues.

<sup>67</sup> See Sweet (1967b), for biographical information.

### 2.3.3 The Wernerian Society and the Public

Attempts at public promotion of the society came from Jameson himself in 1817 in an article in *Blackwood's Magazine*:

Most of the active members of this society are professional men, whose daily engagements circumscribe the sphere of their scientific utility; yet notwithstanding this and other disadvantages, they explored a large portion of country, have contributed several valuable papers which have been published, besides others of equal importance, which will in due season appear at the bar of the public.<sup>68</sup>

Porter suggested that the Society's meetings were more akin to Jameson's research seminar than a Society of equals, but new evidence casts doubt on these claims. Only in some respects did the 'queries' circulated by the Society seek 'corroboration of the Wernerian system',<sup>69</sup> and, as already shown, many papers, even in the earlier years of the Society, did not even discuss Wernerian theory.

In *Blackwood's Magazine*, (1817), Jameson intended to lend praise and support to the Society's members:<sup>70</sup>

We make no apology for submitting to the public the following sketch of the rise, progress and present state of the *Wernerian Natural History Society of Edinburgh*, as well as a few general observations on that branch of natural history to which some of its most distinguished members have hitherto devoted their talents.<sup>71</sup>

Further:

The history of the society is in fact so intimately blended with the progress of mineralogical science in Great Britain, as to make it impossible to notice the one and neglect the other. To this society we, without hesitation, refer not only a large share of the enthusiasm that has been kindled, but some of the most interesting observations on the internal structure of Great Britain that have yet been presented to the world.<sup>72</sup>

Jameson also praised the efforts made in teaching and promoting science through the meetings:

---

<sup>68</sup> *Blackwood's Magazine*, June, (1817). Vol.1. No. III. 233.

<sup>69</sup> *Phil Mag* (1808), 282.

<sup>70</sup> EUSC Gen.1999. The anonymous author of this article could have been Jameson's friend, A. Edmontson of Lerwick, Shetland. In a letter to Jameson he suggested that he would be happy for it [an article] to appear in *Blackwood's* provided the author's name be kept concealed. There is, however, no proof that this was the article in question but the dates coincide.

<sup>71</sup> *Blackwood's Magazine* June (1817). Vol.1. No. III 231.

<sup>72</sup> *Blackwood's Magazine* June (1817). Vol.1. No. III 231.

In this state of general scientific excitement, those who felt anxious to render it beneficial, naturally sought for channels through which its influence might be judiciously directed. The most obvious was the establishment of societies, which, while protecting and encouraging every branch of natural history, would afford due support to mineralogical science in all its parts whether regarded as furnishing materials for the philosophic enquirer or as directing the operations of the practical mineralogist.<sup>73</sup>

The objectives of the Society were wide-ranging and in keeping with practical, empirical methods of enquiry. They aimed at the general promotion of every branch of natural science with mineralogy the most important in its early years. Jameson's will did not always prevail, however, and those members who chose to cavil rather than reflect objected to a narrow scope they thought the founders had instilled in 1808. The journal article, thinking that their aims and objectives were similar, ended with a plea that the Society be more co-operative with the Geological Society of London:

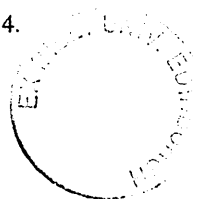
The course hitherto adopted by the Wernerian Society has been unquestionably good – though not so brilliant as it might have been had it possessed some advantages not wholly unknown to others. Upon the whole however, we are disposed to think that a quiet unobtrusive career, in which solid foundations for future distinction and rapid foundation are laid, is to be referred to that rapid course which dazzles for a while, but leaves no fixed and permanent impression.<sup>74</sup>

Jameson appeared to think that the Society would do good things but that it would neither leave a lasting impression nor produce any great or notable science. This may, perhaps, be an admission that he was entering into a world where interesting science was considered specialised, based on hypotheses and speculation as well as being theory bound and professional. A natural history society based on Baconian principals of observation, practical in method and conducted by amateurs whose collective philosophy was more akin to eighteenth-century antiquarianism would not either excite or fulfil public demand for specialised natural knowledge based on speculation and hypothesis testing.

---

<sup>73</sup> *Blackwood's Magazine* June (1817). Vol.1. No. III 232.

<sup>74</sup> *Blackwood's Magazine* June (1817). Vol.1. No. III 234.



### 2.3.4 The End of the Wernerian Natural History Society

Meetings took place until April 1858 but with ever decreasing regularity, sometimes as few as once a year.<sup>75</sup> The Society declined in membership and type of activity in the 1830s. In November 1857, the Society was finally disbanded when a Committee met to end its affairs. After Jameson's death in 1854, the Society became moribund, and, in 1858, was incorporated within the Royal Physical Society of Edinburgh and the Botanical Society of Edinburgh with its funds divided two thirds to the former and one third to the latter. Books on botanical subjects were given to the Botanical Society and the remainder, with some exceptions, to the Royal Physical Society.<sup>76</sup>

At a meeting of the Wernerian Natural History Society held in the college on Saturday 28<sup>th</sup> November 1857 called by public advertisement – it was unanimously resolved that the said society be dissolved and that the member be incorporated with the Royal Physical society and the Botanical Society of Edinburgh. The funds and property of the Wernerian Society being divided in certain proportions between these societies and the College Museum.<sup>77</sup>

The last entry in the minutes suggests that members be admitted to the Botanical Society.

Jameson's Society, despite having attained an international reputation, did not derive as much success as it would have liked. Its demise, like its inception, was not necessarily a reflection of public reaction to the Wernerian system although its namesake may have driven many to assume a false association of its true aims, goals and methods. Jameson's control and influence declined rapidly soon after the Society's inception, a claim reflected in the number of articles Jameson published during the first ten years of the Society's existence, and the lack of articles on mineralogical topics after 1820. As I shall argue, it was not only Werner's doctrines that declined in public interest, but the wholesale study of geology and natural history in favour of professional pursuits in law

---

<sup>75</sup> The Society met fairly regularly in 1847 after which there was an interval during Professor Jameson's illness when no meetings were held. There were irregular meetings in 1849 and 1850. A summary of the proceedings of the late meetings of the Wernerian society was given by Professor Balfour in his presidential address to the Royal Physical Society in 1858, which appears in the *Proceedings of the Royal Physical Society*, Vol. 2. 6-12.

<sup>76</sup> Details of this incorporation are given in the proceedings of the Royal Physical Society Vol. 1. 436-7, where a list of members of the Wernerian Society at the date of incorporation is also given.

<sup>77</sup> EUSC MS Dc.2. 56. Minutes of the *W<sup>N</sup>H<sup>S</sup>* Vol.2. (1857), 410.

and medicine. The Society never reached beyond the professional with amateur interests in natural history, those who had not chosen it as a career.

I have shown the Wernerian Society and many of its members were not as devoutly ‘Wernerian’ in their outlook as has been assumed given that the Society was named after him. The Wernerian Society was not as dominated by the thoughts of its sole president (except in its early years where Jameson remained very active until the 1830s<sup>78</sup>), and members often held multiple memberships of other Societies, including the RSE.

Activities with the RSE were often not acrimonious; frequent exchanges of *Memoir* copies, specimens and gifts between them added to its public profile and the argument that it was a society founded on contrasting scientific or ‘intellectual’ principles to the RSE. Members of the RSE never viewed Jameson’s Society as either a scientific rival or a threat to its own existence.

## 2.4 Conclusion

In this chapter I have compared the operations, aims, goals and methods of two scientific societies dedicated to topics in geology and natural history in early nineteenth-century Edinburgh. In the formal learning place, and as sites for the advancement of natural knowledge, I have shown that their aims and intentions differed markedly yet that acrimony between them was effectively minimal.

Firstly, I have shown the RSE to be dominated by a committee intent on promoting verificatory and refutatory evidence in favour of Huttonian theory, to label itself ‘Huttonian’ in the public realm and to carry forward geological ideas in the intellectual context of theoretical reasoning. In contrast, I have shown the Wernerian Natural History Society – despite its names and occasional papers pertaining to Wernerian theory – to be less dominated by geological topics and to have been based primarily on Baconian principals of inductive method through empirical observation.

---

<sup>78</sup> The final volume of the *Transactions of the Wernerian Society* (Vol. 8) was completed in 1839. Brief proceedings of the meetings of the Society continued to be published in the *Edinburgh New Philosophical Journal*, the last being in Vol. 46 (1849), 371-2.

Secondly, the RSE's Committee was made up of devotees of the Huttonian system, who, whether landed amateur or professional, concerned themselves with actively promoting the Huttonian cause. Apart from Jameson, and a few close associates, the professionals who frequented the Wernerian Society showed interest in geology and natural history only as a minor or part-time component. It was a Society for the 'amateur' pursuit of natural history as hobby or pastime rather than career and therefore rarely became embroiled in issues relating to theoretical 'causes'. Whilst exclusion from the RSE Committee occurred on the grounds of geological theory, Wernerian Society members actively argued for theory to be omitted from proceedings, as was the case for Thomson and the Society's Charter.

Thirdly, the non-acrimonious co-existence of these societies, the frequent exchange of gifts and publications between them and dual memberships suggest that neither perceived the other as an 'intellectual' threat. This adds support to the argument that the RSE and WNHS operated in different intellectual contexts, one theoretical and specialised, the other primarily amateur and practical. The RSE's public profile was important to its own self-image, for securing the right to display their own property and assert themselves under the Huttonian label. The Wernerian Society remained relatively small in number, Jameson using his museum and the classroom to assert his reputation and did not require the political need to be bold.

It is not just in the formal setting of the scientific society, however, that Jameson should be viewed as advocate of Wernerian geological theory. I will now show that similarities existed in an academic context through attention to his methods and approaches to geological teaching.

# 3

## INSTRUCTION: GEOLOGICAL TEACHING

### 3.1 Introduction

In the same way that Jameson's Society differed in its methods from the RSE, I shall show that the role of geological theory in his teaching has also been overplayed, and whilst it occurred, it may now only be considered as one component. Put simply, Jameson primarily taught according to Baconian inductive principles and used a classificatory schema to describe nature. He was also conservative in style. In contrast, Huttonians in the university, whilst not officially responsible for the teaching of geology, used rather different methods more akin to verificatory principles for their particular subjects. Thomas Hope, in particular, gave practical demonstrations using analogy and metaphor as tools for explanation and delivered them with superior oratory skill.

Similarly, Jameson neither rated chemistry highly nor used laboratory experiments for promoting Wernerian ideas. By contrast, verificatory chemical experiments were used effectively to promote Huttonian theory. In this chapter, I shall argue that the scientific methods adopted by disputants were conducted in differing 'intellectual' contexts. The result was that this was not just a conflict about rival theories but one driven by concerns about method: a conflict between *militant* Huttonians who adopted verificatory methods and *resistant* and conservative Wernerians, who, as I shall show for teaching, resorted to teaching Wernerian ideas by use of factual or inductive principles.



I shall assess the Wernerian content of Jameson's teaching in two ways. Firstly, attention is paid to his style of approach through the testimonies of others, and secondly, I explain the significance of what he taught and the methods employed in its execution.

### 3.1.1 Natural History Teaching at Edinburgh University (1790-1820)

Despite some attempts to discuss science in Scottish universities, geology as it was taught and developed has not received much attention, particularly for the early nineteenth century. Geology, however, was one product of the education system in place at Scottish universities in the early part of the nineteenth century. I shall discuss this in more detail as a necessary precursor to a full understanding of Jameson.

For Morrell, British universities in the Enlightenment have been appropriate to study because their aims, organisational structures, financial arrangements and teaching styles have been well defined.<sup>1</sup> Scottish and English universities also differed, in teaching methods, philosophy, and in traditions of property and patronage.

Of the Scottish universities, Edinburgh has featured prominently. The University gained one of the highest reputations in Europe for scientific education that arose through a move to enhance quality teaching in the late eighteenth century.<sup>2</sup> Unlike Oxbridge, its buildings did not form the central focus of civic life and students lived in private accommodation. Edinburgh did not have a tradition of property and patronage, but instead relied on an individual remuneration system whereby students paid a small sum per lecture. John Lockhart noted these differences:

In these places [Oxbridge] the university is everything; the houses of the town seem merely to be the appendages of the colleges, and the townsmen themselves only a better sort of menials to the gowns-men... Here [Edinburgh] the case is very different...instead of all this proud and sweeping extent of venerable magnificence, the academical buildings of Edinburgh are piled together in one rather obscure corner of a splendid city.<sup>3</sup>

---

<sup>1</sup> Morrell (1971).

<sup>2</sup> Morrell (1971), 1. Edinburgh University's reputation for science was well known throughout Europe by the late eighteenth century. Its high regard is perhaps best exemplified by Thomas Jefferson's famous quote in a letter of June 21, 1789 written to Dugald Stewart and cited by Horn (1967). Jefferson was convinced that for science "no place in the World can pretend to a competition with Edinburgh".

<sup>3</sup> Lockhart (1819), Letter VI.

Lockhart suggested that even lack of ‘academical’ dress aided in creating a peripheral atmosphere: “there are no *gownsmen* here”, he said, “and this circumstance is one which, with our Oxford ideas, would alone be almost sufficient to prove the non-existence of a university”.<sup>4</sup>

Wood argues that the relationship between ‘town’ and ‘gown’ has only recently begun to emerge beyond the mere ‘anecdotal’ to be the subject of serious historical questions about the interaction between universities and *civic* culture.<sup>5</sup> Changes in Scottish University education in the late eighteenth-century promoted and drastically altered the nature of the relationship that Wood discusses.<sup>6</sup>

Subjects taught were transformed by improved teaching methods. In natural philosophy, John Robison was influential, as was John Playfair for mathematics. Adam Ferguson and Dugald Stewart revolutionised moral philosophy, Andrew Coventry brought in new ideas to agriculture and Cullen and Black ushered in a new regime for chemistry that was continued by Thomas Hope.<sup>7</sup> John Walker was widely praised for his lecturing in natural history<sup>8</sup> and Robert Jameson continued John Walker’s tradition of high quality teaching in natural history with similar content and style.

At Edinburgh, students could enter university at fourteen years old or younger. This concentration of youth often produced riotous lectures about which Lockhart described the attendants as: “sets of giddy urchins who, although addressed as ‘Gentlemen’ are, in fact, as full of the spirit of boyish romping as at any previous period of their lives”.<sup>9</sup>

---

<sup>4</sup> Lockhart (1819), Letter VI.

<sup>5</sup> Wood (1994).

<sup>6</sup> The nature of Scotland’s universities at the end of the eighteenth and beginning of the nineteenth centuries has been the subject of many studies. Useful works are Horn (1967) and Davie (1961). Anderson (1995) concentrates on School education in Scotland. Science pedagogy has not received as much attention in the literature, the best works being Wood (1994), and Morrell (1967), (1971), and (1972). There has been no separate study specifically devoted to the teaching of geology or natural history in the University of Edinburgh at this time.

<sup>7</sup> Donovan (1975).

<sup>8</sup> For more on John Walker relating to the university, see Withers 1989; 1992; 1995, 65-77.

<sup>9</sup> Lockhart (1819), Letter VI.

Edinburgh's uniqueness was the result of a pre 'Act of Union' Presbyterian polity.<sup>10</sup> This resulted in a most basic difference between the Scottish and English systems, the first, generic in nature, the other more narrowly focussed. Whereas the Scottish system aimed at *general* education, the English system was concerned with specialisation. A visitor to Edinburgh, Mr 'Wastle' was in no doubt where his allegiances lay:

So far from proceeding, as I had supposed every Scotchman in like circumstances would do, to point out the advantages which might be expected to arise, and which in Scotland had itself already, in fact, arisen, out of so liberal and extensive diffusion of the higher species of education, my friend seemed to have no hesitation in condemning the whole system as being not friendly, but eminently hostile, to the true interests both of science in general and of his country. Without at all understanding him in the literal sense of his words, I think it is possible that the result of his reflections may have really led him to doubt whether the system which takes in so much may not be somewhat weakened and debased through the very extension of its surface.<sup>11</sup>

Why was the broad education system so strictly adhered to in Scotland? George Davie discusses social explanations at length.<sup>12</sup> Morrell also identified a combination of changes that he labelled 'internal' and 'external'. These 'external' influences were identified to be: a crisis of Scottish identity manifest in various forms of nationalism, the secularisation of Scottish Calvinism through the dominance of the moderate party of the Church of Scotland, general high literacy levels established in lowland areas of Scotland through compulsory primary education in parish and burgh schools, and cultural patronage exerted by a large landed class.<sup>13</sup> Morrell's 'internal' forces were defined as the relationship between the university's institutional characteristics and how they related in particular to science.<sup>14</sup> These 'internal' characters of education at Edinburgh and in Scotland's universities more generally shaped both what was taught and, more importantly, how.<sup>15</sup>

---

<sup>10</sup> Davie (1961), 4.

<sup>11</sup> Lockhart (1819), Letter IX.

<sup>12</sup> Davie (1961), Chapter One.

<sup>13</sup> Morrell (1971), 159.

<sup>14</sup> Morrell (1971), 159.

<sup>15</sup> Morrell and Davie have both paid considerable attention to the 'philosophical' or eclectic and non-specialised nature of early nineteenth-century Scottish education that was disliked by the University Commissioners of 1826-30.

Edinburgh's *generic* education policy led to the comparatively late introduction of practical forms of learning. Demonstrations in the chemistry course did not occur until 1823, making practical experiments an activity for private consumption. Jameson did not rely on practical class demonstrations, or the use of chemistry to conduct his own lectures. Jameson associated the field and museum, not the classroom, as practical pedagogic space.

Davie argues that the over-emphasis on non-practical, philosophical education did not produce a supportive response from other academic subjects, but demanded, rather, they became more philosophical.<sup>16</sup> This 'philosophical' nature of teaching gave rise to a characteristically humanist flavour in science subjects. It was usual in Scotland to give a large amount of attention to the first principals and metaphysical ground of the disciplines. How did this 'philosophical' form of education as a product of previously identified 'external' causes affect teaching in natural history and geology? What ramifications did it have for the way geology was developed, particularly by Jameson?

### 3.2 Jameson's Geological Teaching

Despite a personal interest by other professors in matters geological, the official task of teaching it fell to Jameson. Geology was only a small component of a broader-based natural history course that Jameson had personalised since taking up the chair. Jameson's teaching met with a multitude of responses and reactions by students that attended the course during his fifty-year tenure.

Wood argues that Walker's evocation of the ideals of ornateness and politeness explain the cultural values espoused by fellow professors, and provide illustration of how an educated gentleman served as the perfect vehicle for the insertion of natural knowledge into the public sphere.<sup>17</sup> Having inherited these 'established' values, Jameson became a worthy successor. By 1804, he had been training for many years and was aware of the importance of his museum as a pedagogic tool.

---

<sup>16</sup> Davie (1961), 12.

<sup>17</sup> Wood (1994), 108.

Jameson began to employ more practical methods of teaching than Walker by introducing field excursions for students. Chitnis has noted that Jameson undertook extensive field investigations both before and during his time as professor and keeper.<sup>18</sup> Use of the field as a teaching aid was most likely brought about by the influence of Werner, who used excursions into nature to teach his students at the *Bergakademie* in Freiberg. Where Walker had been content to demonstrate by means of specimens alone, Jameson introduced the concept of *in-situ* observation. How did Jameson actually go about this? Apart from the methods employed, can be inferred about the nature of Jameson's teaching by reference to the written experiences of his pupils.

### 3.2.1 Jameson's Classes

The figures of Jameson's class attendance given to the 1826 Commissioners are unsatisfactory in that the only years accounted for are 1807-8 (50 students) and 1825-30 (200 students).<sup>19</sup> That so, Jameson told the Commissioners that when he first took the chair he was drawing on thirty-five students and that now (1826) he could count on two hundred with regularity.<sup>20</sup> For several reasons a variety of people attended from surveyors to civil engineers.<sup>21</sup> Firstly, natural history was a compulsory component for Edinburgh's medical degree,<sup>22</sup> and, secondly, new army regulations required that candidates in its medical department must produce certificates of having attended at least three months lectures in natural history and three months in botany.<sup>23</sup> Naval surgeons were required by the Admiralty to be instructed by Jameson in the collection and preservation of geological, botanical and zoological specimens.<sup>24</sup> Jameson's classes were well attended, despite a compulsory component to them. Paradoxically, his style of delivery, has not been the subject of great praise.

---

<sup>18</sup> Chitnis (1968), 197.

<sup>19</sup> *Evidence* 1, 130-131.

<sup>20</sup> *Evidence* 1, 144.

<sup>21</sup> *Evidence* 1, 142. Jameson said of the engineers in his class, "they consider that the geological department of the course is intimately connected with part of their operations".

<sup>22</sup> *Ed New Phil Trans* (1833), 14, 208.

<sup>23</sup> *Ed New Phil Trans* (1833), 16, 200.

<sup>24</sup> Cunningham (1990), 14. It was from this contact that Jameson acquired so many specimens and so much knowledge from polar expeditions undertaken by the Navy.

### 3.2.2 Style: Jameson's Approach to Teaching

Jameson's teaching abilities were often called into question, perhaps most famously exposed by Charles Darwin's comments upon taking the natural history class (compulsory for medical students at the time) in 1825. Darwin notes that far from being encouraged to take up geology,<sup>25</sup> he gained only "the determination never as long as I live to read a book on geology or in any way to study the science".<sup>26</sup> So dull and 'factual' did Darwin find the lectures, he was known to have mimicked Jameson's style of delivery with a considerable degree of derision saying: "Gentlemen, the apex of a mountain is the top and the base of a mountain is the bottom."<sup>27</sup> Others testified that they thought the lectures too factual and stylish expositions were not 'Jameson's *métier*'.<sup>28</sup>

According to James Ritchie, Jameson's use of metaphor was so scarce that the few he used were so well known to students that when produced they were welcomed with rounds of applause. "Lectures" said one disgruntled student, "were like the table of contents of a book being read out for an hour". Thomas Carlyle called them: "a chaos of facts". Audubon said that "the man was strange and uncouth" and another referred to Jameson as a "baked Mummy".<sup>29</sup> George Wilson, later professor in the university, also mentioned Jameson's dryness and reserved nature:

Jameson was a remarkable man. Grave, taciturn, and reserved in manner, devoted especially to mineralogy, the narrowest in some respects of all the departments of the science he professed, he seemed much better for the secluded life of a student, than for the duties of a university chair.<sup>30</sup>

Wilson also suggested that Jameson was abstinent in his support of Werner. Jameson delivered the lectures within the bounds of a sphere of wider more empirical natural knowledge. Wilson continued: "Intercourse with him [Jameson], soon dispelled the

---

<sup>25</sup> Secord (1991a), 134.

<sup>26</sup> Barlow (1958), (ed.), 52-3. See also Secord (1991a), 134.

<sup>27</sup> *Darwin Correspondence*. 112 (ser. 2): 43. In Browne (1995), 70.

<sup>28</sup> Browne (1995), 70.

<sup>29</sup> Ritchie (1956): Browne (1995), 70.

<sup>30</sup> Wilson and Geikie (1861), 109.

notion that he was a man wrapped up in himself, happy only when fingering or scratching minerals”.<sup>31</sup>

Thomas Carlyle was particularly scathing in his analysis of Jameson’s teaching style. Archibald Geikie recalled when Carlyle reminisced about his college days, saying that Jameson had not inspired him:

His college days came into his mind as we chatted. He laughed when he gave us some of the reminiscences of the lectures of Robert Jameson, the professor of natural history at the university. He said that Jameson had never done him any good, had no power of interesting him in the subject, and rambled so widely from one topic to another that it was hardly possible to follow him. Thus the professor would suddenly stop in the middle of some details and exclaim, “we shall now consider the order *Glirres*,” whereat, as he recalled the incident, Carlyle, roared with laughter, adding how the professor “dwelt upon four chisel teeth.”<sup>32</sup>

Carlyle attended Jameson’s class in the session 1818-19. According to Campbell, Carlyle was prone to making judgements on the personal response behind the reputation rather than the reputation itself.<sup>33</sup> Carlyle didn’t rate Jameson even as a young student. In writing to Robert Mitchell he said:

I have heard professor Jameson deliver two lectures. I am doubtful whether I ought to attend his class after all. He is one of those persons whose understanding is over-burdened by their memory. Destitute of accurate science, without comprehension of mind, - he details a chaos of facts, which he accounts for in a manner as slovenly as he selects and arranges them. Yesterday he explained the colour of the atmosphere, - upon principles which argued a total ignorance of dioptrics. A knowledge of the external character of minerals is all I can hope to obtain from him.<sup>34</sup>

Carlyle’s feelings for Jameson’s lectures never changed or faded. He stated to Geikie: “In regard to the teaching of geology, there was at that time no inducement to attend the University of Edinburgh”.<sup>35</sup>

Less scathing than Carlyle, J. D. Forbes also described Jameson’s teaching manner in some of his letters. His initial description was of a man whose personality did not contribute well to a favourable style of lecturing. In the year 1827-8, Forbes took two courses, the first was Professor George Wilson’s, the second Jameson’s:

<sup>31</sup> Wilson and Geikie (1861), 109.

<sup>32</sup> Geikie A (1924), 133.

<sup>33</sup> Campbell in Donaldson (1983) (ed.), 63.

<sup>34</sup> Carlyle (1886), *Early letters* Vol. 1. p. 192. Letter to Robert Mitchell, Edinburgh, 27 November, 1818.

<sup>35</sup> Geikie, A (1924), 31.

These two teachers were both eminent in their way, but very different from each other. Professor Wilson discoursed at large on his subject, if with no vast learning or keen edge of subtlety, yet with a flow of fervid and poetic eloquence, which fired youthful imaginations, and helped to let loose over Scotland those floods of turbid rhetoric, which from pulpit and platform have deluged it for a generation, and are only now abating. Dr Jamieson [sic.] plain, practical, not to say prosaic, but accurate, painstaking, and diligent as an observer, so rarely ventured on figures of speech.<sup>36</sup>

Jameson's dryness of manner did not excite pupils but it would appear that he was very methodical and precise in what he did. His eye for detail was impaired by what many considered a poor oratorical style.

Although Jameson's teaching as a performance left much to be desired, it must not be forgotten that he was well respected internationally as one of Europe's finest mineralogists. Archibald Geikie noticed this seeming paradox. Although only very young at the time of Jameson's keeper-ship, Geikie also had an impression of Jameson's teaching activities as poor but could never deny that some of his pupils – mostly those who were non compulsory attendance - left fully inspired, some for a lifetime:

Jameson was probably somewhat dry as a lecturer. There can be no doubt that he had the reputation for being richly methodical in his prelections; but he certainly had the merit of inspiring some of his pupils (Edward Forbes and others) with a love of natural science. Yet we can well understand how he might repel the future author of *Sartor Resartus*.<sup>37</sup>

Even Jameson was aware of this. In a letter to Roderick Murchison, Jameson even described himself as overly 'cautious':

I regret my former pupil Boué occasionally forgets the lessons of caution I give in my geological lectures. Am explaining just now structure of the mountain range to 100 disciples. In 10 days start with 130 pupils to explain geology of part of Central Scotland I do what I can to inspire the young men with a taste for natural history.<sup>38</sup>

According to this evidence, Jameson's style of delivery was not inspirational. Whether this was a factor in causing lack of interest amongst students in either natural history or geology must remain uncertain. In Lockhart's letters, there was more widespread evidence of disinterest in the natural sciences:

From various conversations however, with himself, Dr Brewster and some of the young gentlemen whom attended the professor's [Jameson's] lectures, I am sorry to hear that on the

---

<sup>36</sup> Wilson (1861), 37.

<sup>37</sup> Geikie A, (1924), 133. The author was Thomas Carlyle. Translated as '*The Tailor Re-clothed*'.

<sup>38</sup> GSL MS. Robert Jameson to Murchison, Roslin, 14<sup>th</sup> June, 1829.



whole the science of natural history neither has been, nor is cultivated throughout Scotland with any degree of zeal corresponding to the opportunity which the country affords. It's natural advantages are far superior, in most respects, to the sister kingdom; and the situation of Edinburgh, in particular, may be justly regarded as more favourable than any in the island for the pursuit of this delightful study. Indeed it would not be easy to determine why a higher state of advancement has not been attained; and the difficulty is much increased when we consider that, in addition to the great facility which this most picturesque district affords for the pursuit of the science, the professorship of natural history has already been held for several years by the assiduous and intelligent gentleman of whom I have spoken so much.<sup>39</sup>

According to Lockhart, natural history was not universally popular as an academic pursuit. What is more uncertain is whether blame for this state of affairs should be directed at Jameson. Did Jameson's dry manner and conservative nature deter interest in natural history? Was it merely a lack of interest in matters concerning the natural world in favour of other professional pursuits? It is difficult to attribute sole responsibility for this state of affairs Jameson's style of delivery. In support of this claim are the favourable testaments to Jameson's ability from students who were interested in natural history, and the general lack of interest in natural history in favour of more professional pursuits in civic culture. Let me explore this further.

Chitnis has suggested that "the university's contribution to Natural History and allied matters was a highly important one from 1790-1826, in many ways Edinburgh was the world's greatest centre of study for this".<sup>40</sup> Despite this, Jameson had trouble attracting the kind of student he desired, attributing the pursuit of professional careers, mostly in the operations of law and medicine as being responsible for a general lack of interest:

I am inclined to attribute this to the joint operation of a number of causes; but I observe that Professor Jameson himself considers the too engrossing influence of the law as being the most immediate and effectual of all the dampers under which his favourite study has so long languished. Most the young men of this city are trained up either as barristers or attorneys; and it very unfortunately happens all more liberal pursuits (both classical and scientific) so far from being much respected or held in estimation by these classes of men, are for the most part regarded as quite inconsistent with a diligent discharge of their professional duties and functions.<sup>41</sup>

Natural history, presumably the privilege of the landed amateur or antiquarian was less appealing for the formulation of a career as the century wore on. Jameson told Lockhart

---

<sup>39</sup> Lockhart (1819), Letter X.

<sup>40</sup> Chitnis (1968), 194.

<sup>41</sup> Lockhart (1819), Letter X.

that the compulsory structure of his class numbers, mostly medics and military men, did not help his cause. Jameson also explained that poor farming practices in the rural areas of Scotland were so bad that indigenous students would not be able to enjoy what they had learnt to the full:

I observe that professor Jameson himself informs me that three fourths of the students who attend his lectures are strangers and students of medicine, chiefly English. Those of the last mentioned faculty, who are indigenous to Scotland, have, til very lately at least, either procured appointments in regiments stationed in foreign quarters or retired to distant corners of the country, where the entire absence of books, and the laborious and unsettled life enjoyed, or rather endured, by rural practitioners, have been more than efficient to extinguish every spark of science which might have been kindled in their bosoms during their attendance at university.<sup>42</sup>

Apart from those who chose professional pursuits, not all students who took Jameson's course poured scorn upon it. Those whose reasons for attendance were for its intrinsic interest appeared to derive much pleasure from it, Lockhart being amongst the first:

In truth, I should think the whole science of natural History as a popular branch of education is likely to assume a new aspect under the auspices of the ingenious and indefatigable man. The same acuteness which has enabled him so completely to overcome all the difficulties of his own favourite department will ere long, I doubt not, elevate him to the first rank among the zoologists of Britain, and he will soon have the honorable satisfaction of instituting a school of natural history in the Northern Metropolis which may long remain unrivalled in any other country.<sup>43</sup>

Despite poor oratory skills, Jameson gave a lot of his time to interested parties. This suggests that it was not so much Jameson's dry-mannered approach that caused lack of interest than the fact that, for many, the course was compulsory. When one looks at the 'quarter', who, according to Jameson, attended for reasons of interest, the results of their endeavours were staggering. Many went on to become great scientists and explorers. Of Jameson's students in the period 1804-1826, no fewer than seven went on to hold university chairs: David James Forbes,<sup>44</sup> Edward Forbes (who succeeded Jameson to the Chair of Natural History); Robert Grant; James Nicol; Louis de Saussure; Edward Turner; and William MacGillivray, Jameson's assistant. Many of Jameson's students became officials of the Geological Society of London, such as

---

<sup>42</sup> Lockhart (1819), Letter X.

<sup>43</sup> Lockhart (1819), Letter X.

<sup>44</sup> Cunningham (1990), 16. J. D. Forbes was said to have enjoyed Jameson's course so much in 1827-8 that he repeated it in 1828-9 for reasons of intrinsic interest.

William Henry Fitton and Leonard Horner for whom “the progress of geology claimed the most zealous attention and became the chief occupation of his leisure hours”.<sup>45</sup>

Four of Jameson’s students became significant explorers:<sup>46</sup> Sir John Richardson, William Scoresby, Walter Dudley and Alexander Gordon Laing.<sup>47</sup> Lengthy correspondence to Jameson from these pupils and many others lend weight to the claim that his influence was far from negative. Indeed, George Wilson, whilst disapproving of Jameson’s style, commented upon the close bond Jameson established with some students:

The veteran of whom we speak, [Jameson] though his militant days were over, followed the marching regiments in his litter, and watched with keen interest the tactics of the young generals. They took their own way, and he grimly or graciously bade them God-speed. He encouraged his younger colleague James D. Forbes, in his beautiful and elaborate researches on the glaciers. To him, Edward Forbes dedicated the first fruits of his explorations in the sea; and John Goodsir consulted with him about those investigations in Comparative Anatomy, which, even in his student days, gave promise of the fruit they are so richly producing. Under a grave eclectic like this, natural history peacefully passed through a great crisis, and probably underwent a much more equal development in all its branches than it would have done under a more original but more one-sided master.<sup>48</sup>

Laurence Jameson too, mentioned the high regard many of Jameson’s interested students felt towards him:

His pupils were even more valuable. The greatest praise of a great professor is that which proclaims he has founded a school and where else in the British Empire, except here has there been for the last century a ‘school’ of natural history.<sup>49</sup>

Jameson’s commitment to topics in natural history made him highly respected despite having disagreements with other professors for his early commitment to the Wernerian doctrine. Having suggested that Jameson had a dry teaching manner but not attributing that as the major cause of the lack of interest in natural history and geology, I shall now go on to assess the subject matter itself. What did Jameson actually teach and how? What were the implications for the development of geology and natural history, particularly in a theoretical sense?

---

<sup>45</sup> Lyell (1832), 1, 13

<sup>46</sup> On the relationship between Jameson and Arctic explorers see Sweet (1974).

<sup>47</sup> Jameson contributed and produced publications from the materials sent to him by his pupils. See chapter seven.

<sup>48</sup> Wilson and Geikie (1861), 118.

### 3.2.3 Methods: Jameson's Natural History Course

Secord noted that Jameson's teaching was built upon the principle of 'order', Jameson suggested to the Commissioners in 1827 that

Natural History itself is a species of Natural Logic; it serves to exercise the mind in as correct a way as logic properly so called. Those boys who attend the class acquire a distinct conception of numerous natural objects and reason with great accuracy, owing to their being instructed in methods of arrangement and to their being obliged to use precise and accurate language in everything they do.<sup>50</sup>

Highlighting this attention to order, Secord shows that Jameson's teaching advocated a relatively static classificatory geology focused on the ordering of strata through use of Wernerian terminology, and that its merit was its 'flexibility'.

Jameson taught an extensive course of lectures each year.<sup>51</sup> When asked by the 1826 Commissioners if he completed the entire course in one session, he replied: "some seasons I have taken a more extended view and I have been obliged to divide it one half in the winter and the remaining portion in the summer".<sup>52</sup> The course covered meteorology, hydrography, mineralogy, geology, botany and zoology.<sup>53</sup> In geology, Jameson treated of the 'Earth's composition structure and mode of formation', in line with the broad-based nature of science teaching at Edinburgh.<sup>54</sup> There were no fewer than 273 different lecture topics listed in Jameson's syllabus.<sup>55</sup> For Lockhart:

The professor delivers his lectures both during the winter and summer season, and he divides his course into five great branches: Meteorology-hydrography-Mineralogy-a sketch of the philosophy of botany sufficient to enable his pupils to understand the relations which subsist between that science and a complete history of the inorganic parts of the globe – and lastly, Zoology. The first of these divisions is rendered particularly interesting by the number and variety of curious facts which are collected, and the more so as there are scarcely any books written professedly on the subject.<sup>56</sup>

---

<sup>49</sup> Jameson L, (1854), 198. Chitnis (1968), 199.

<sup>50</sup> *Evidence* 1, 145. In Secord (1991a), 138.

<sup>51</sup> Jameson L, (1854), 29.

<sup>52</sup> *Evidence* 1, 146.

<sup>53</sup> *Evidence* 1, 146.

<sup>54</sup> Chitnis (1968), 199.

<sup>55</sup> Chitnis (1968), 187.

<sup>56</sup> Lockhart (1819), Letter X.

Jameson's pre-course syllabus promised lectures on the *Theory of the Earth* and the *Deluge*.<sup>57</sup> The broad-based nature of the course was regarded by those who wrote about him as one of Jameson's greatest assets, in contrast to a specialised English system and in keeping with the teaching philosophy in Scottish universities. Lockhart, especially, commented on the usefulness of the many topics included:

Professor Jameson is chiefly known to the world as a mineralogist, and in this character he certainly stands entirely without rival in his own country...but it is not his intimate acquaintance with mineralogy alone which renders Mr Jameson so capable of doing honour to the chair which he holds. He is also greatly versed in zoology, and, what is of great importance in these times, seems much inclined to indulge in those more general and philosophical views of that science which the study of nomenclature and classification has well-nigh banished from the remembrance of most of his brethren in the South...his pupils, I am assured, find him on every both able and willing to instruct them regarding all the recent and most important discoveries and improvements in the other branches of natural science.<sup>58</sup>

Jameson identified for himself five *modes* of teaching natural history. I shall deal with each in turn. First he lectured and demonstrated objects of natural history. Although, as we have seen, these lectures were not uniformly well received, the syllabus that Jameson covered was quite extensive. At first the geology content of the course was included as a sub-section in the major topic of mineralogy. Jameson separated geology from mineralogy because it was concerned with the formation of the earth's crust or the "physiogomy [sic] of the earth's surface". In 1813 Jameson had not acknowledged the use of the word, instead subdividing Wernerian mineralogical terminology and, until 1831, calling that element concerned with formations 'Geognosy'.

In Jameson's later career, he not only utilised the term 'geology', but also separated it from mineralogy. Jameson then considered geology as a topic in its own right. According to student notes written between 1813 and 1832, the overall structure of natural history topics changed little. The geology component remained within a broad Wernerian framework of 'formations'. According to Jameson, geology was not only recognised as separate from mineralogy but grew slowly in importance. From 1813 to 1831 however, it underwent a gradual change, incorporating references to igneous concepts which, even by 1831, did not purport to challenge Huttonian theory.

---

<sup>57</sup> Cunningham (1990), 13. In Forbes' year of attendance, 1827-8 Jameson's 'pre-courses' were not given.

<sup>58</sup> Lockhart (1819), Letter X.

In 1813, student lecture notes reveal that Jameson was still heavily concerned with ‘fighting off’ Huttonians. Although Jameson paid attention to Huttonian theory, (Playfair’s *Illustrations* being on his reading list), he still disagreed with many of its claims on the Baconian grounds that: “the Huttonian theory be at variance with existing appearances”. Jameson demanded its rejection because external characteristics or exterior observation were not considered important as Huttonian methods of investigation.<sup>59</sup> Student lecture notes reveal that Jameson was particularly concerned with these appearances in the context of vein formation, but in rejecting Huttonian explanations, he was not entirely in accordance with Werner’s theory either. Rather he chose a position that incorporated aspects of both:

The theories of the formation of veins are threefold. The first is that which supposes the contained matter to have been injected from below into fissures previously existing in the super-incumbent rocks. This theory is espoused by Dr Hutton and his followers and supports the idea of veins becoming gradually narrower towards the surface of the earth and being of course at their greatest width nearest the source of injection. The second theory is that supported by Werner and many of his school. According to it there has been a successive influx and deposition of the matter of veins in existing fissures, the materials flowing from above. The third theory entertains the most plausible notion on the subject. It is supposed on good grounds that the matter of veins is simultaneous origin with the rock in which it is contained. We have no hesitation in affirming this to our opinion in as much as it accounts for most of the phenomena exhibited by veins and is rejected by none.<sup>60</sup>

Geological theory formed part of the course, understood by Jameson not merely as Wernerian and held - especially in later years- to include all known theories of formation. After 1835 and perhaps before, part of Jameson’s geology syllabus was entitled: ‘Theories of the Earth: Hutton, Werner &c. &c’.<sup>61</sup> Hutton’s system was taught, although not with impartiality: Jameson taught it by use of Wernerian terminology.

Second notes that by the 1820s, Jameson’s Wernerian teaching came under heavy attack in Scotland, and that one of the most controversial points involved the formation of veins of granite and basalt.<sup>62</sup> Similarly, according to J. D. Forbes in the 1827-8 session, general geological principles were taught by Jameson. Forbes, noted Jameson [was] “treating his students to a thoroughly Wernerian version of geology including such

---

<sup>59</sup> EUSC Dc. 3.33-34.

<sup>60</sup> EUSC Dc. 3.33-34.

<sup>61</sup> Jameson L, (1854), 24.

<sup>62</sup> Secord (1991a), 138.

anti-Huttonian chestnuts as the claim that trap-rocks were only pseudo-volcanic and derived their misleading resemblance to the basalts which constitute lava flows from the adjacency of beds of combustable [sic] coal".<sup>63</sup>

Despite Jameson's disagreement, Forbes' testament shows that Huttonian geology was not omitted from the course but that igneous concepts (or plutonic theory) were creeping into his Wernerian schema. This marked a period of the gradual 'softening' of his views that began upon the death of Werner in 1817 and by 1831, Jameson had all but abandoned the word 'geognosy' in his lectures.

In the later 1820s the Wernerian concept of 'formations' was still being taught and through use of Wernerian terminology, but it now incorporated igneous concepts, became dramatically toned down from its previous encounters and did not include many anti-Huttonian statements. It would seem that Jameson, though never prepared fully to abandon the concept of Wernerian formations, had decided to expand the schema to incorporate a whole series of igneous concepts, based on conviction from empirical evidence, that was, ultimately, more akin to Huttonianism. The major Wernerian formations were still present: primary, secondary, tertiary and so on but, by 1831 they had been subdivided to include new categories such as 'primitive-plutonian', granite, syenite, porphyre and the serpentines.<sup>64</sup> The admission of granite as igneous in origin was significant, some of it been previously regarded by Wernerians as derived from aqueous solution because of its exterior stratified appearance.

---

<sup>63</sup> Cunningham (1990), 14. The manuscript correspondence between Jameson and Forbes is in the Forbes Archive, Library, University of St. Andrews. Corr. (31) items with J. D. Forbes, 1832-51. [NRA 13132].

<sup>64</sup> NLS MS 3936 f. 46.

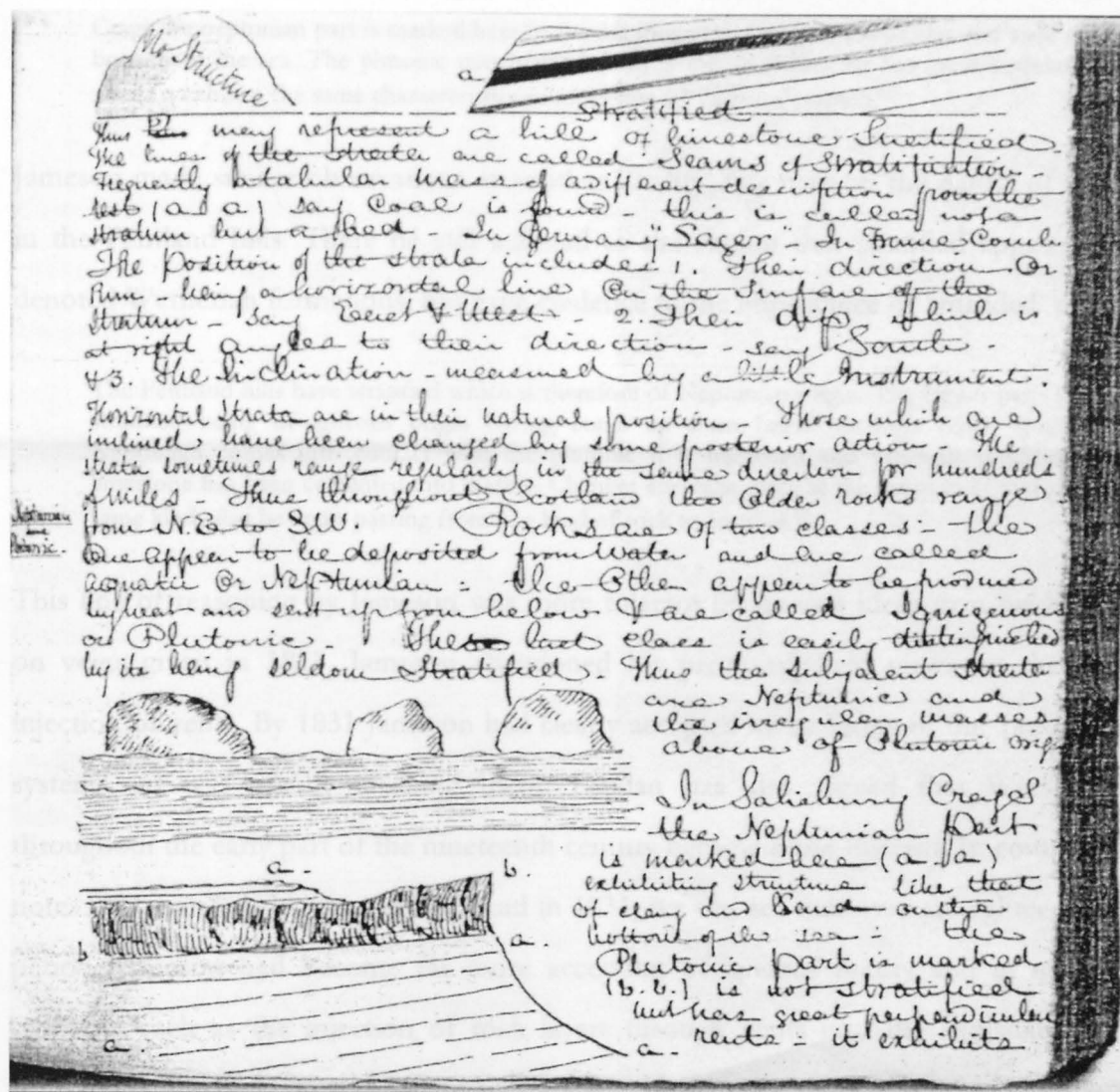


Figure 1. Extract from Student notes of Jameson's lectures by J D. Forbes, 1827-8 showing Plutonic and Neptunian aspects of Salisbury Crags being taught. NLS MS 3936 f62. Printed by permission of the National Library of Scotland.

The incorporation of Huttonian concepts was a significant step in adapting the Wernerian system. It did not merely stretch to the recognition of rock types but also to formations. This was particularly apparent in Jameson's description of the local geology of Salisbury Crags. Once regarded as an entirely Wernerian system formed from aqueous solution, these had by 1831 become a mixed system of plutonic and neptunian explanations. In his lectures Jameson spoke of:

Rocks are of two classes - the one appears to be deposited from water and are called aqueatic or neptunian, the other appears to be produced by heat and sent up from below and are called igneous or plutonic. These heat classes are easily distinguished by its being seldom stratified. Thus the sub-adjacent strata are neptunian and the irregular masses above of plutonic origin. In Salisbury



Crags the neptunian part is marked here (a-a) exhibiting structure like that of clay and sand on the bottom of the sea. The plutonic part marked (b-b) is not stratified but has great perpendicular vents, it exhibits the same characteristics as rocks thrown out of a volcano.<sup>65</sup>

Jameson made similar observations at another locality, this time on the nature of strata in the Pentland hills. There he still adhered to the notion that stratified appearances denoted Wernerian formations, but gave credence to the importance of 'intruded' rock:

The Pentland hills have stratified which is therefore of Neptunian origin. The Upper parts are not stratified being of igneous origin having come up from below through vents. Where the Neptunian comes into contact with the plutonic it is hardened and variously modified thus limestone has been cemented into marble. Changes also take place at the junction of strata of the same kind, also be vents passing from one kind of rock to another.<sup>66</sup>

This line of reasoning by Jameson was more tolerant of igneous ideas than his lecture on veins given in 1813. Jameson abandoned his previously-held views on the heat injection of vents. By 1831 Jameson had clearly accepted many facets of the 'plutonian' system and was openly teaching them. Laudan has also argued that Wernerians throughout the early part of the nineteenth century became more tolerant. In comparing notes on Jameson's lectures in 1813 and in 1831, we can see that over an eighteen-year period, Jameson had become far more accepting of igneous theory and in igneous concepts such as the injection of rock layers through vents into the explanation of formations. Further, from the class syllabus which dates post 1835 (Appendix 3) there are changes in Jameson's own handwriting that suggest he was using both and, even, changing his views on both.

What Jameson had done by 1831 was not to abandon the Neptunian concept of formations first postulated by Werner, but, rather, to incorporate plutonian or igneous rocks as a series that crossed or interjected the great Wernerian formations. He tried to show that igneous rocks could traverse Werner's schema at all its five stages. Jameson was trying to 'fit in' or incorporate undeniable data into an older schema he did not wish to abandon:

The different great classes of rocks of which the crust of the earth is composed have been divided into certain great dimensions 5 in No. of which each has its peculiar organic remains as in figure a.

<sup>65</sup> NLS MS 3936 f. 62.

<sup>66</sup> NLS MS 3936 f. 63.

These formations are never misplaced thus we never find the tertiary below the primitive. But besides these which are considered of neptunian or aqueous deposits there occur plutonian or igneous rocks from below in a state of fusion. These occur in all the formations cutting across or traversing them.<sup>67</sup>

Thus it would appear that a great many concessions had been made to the Huttonian cause but not the ultimate sacrifice, the abandonment of Wernerian formations altogether.

Jameson had very close contacts to many of his students. Along with lectures, Jameson held lengthy conversations before the lecture and after it. He met those attending his course three times a week, often six days a week in the museum.<sup>68</sup> At these meetings, he inquired as to his students' progress and proposed exercises that included writing and descriptions of objects of natural history with which they were previously unacquainted. He considered that descriptions were a "principal object of study", further emphasising his desire for knowledge to be factual and non-interpretative and based on empirical evidence.

In his lectures, Jameson was often either accused or criticised for not using practical demonstration and it was a factor in separating his methods from Thomas Hope after 1823.<sup>69</sup> In his autobiographical notes, Archibald Geikie said of his early life as a student at Edinburgh University that even in the 1850s (shortly before Jameson died), practical demonstrations in lectures were still not included in the classroom part of the natural history course:

The Professor of natural history (which included geology and mineralogy) was Robert Jameson, now a feeble old man, whose lectures were read for him by an assistant, but with no course of practical instruction which forms so essential a part of proper training...as I already mentioned, I now attended the chemistry lectures of Dr. George Wilson who went through a course of practical analysis in his laboratory. Such training would be helpful in the further pursuit of geological studies.<sup>70</sup>

Practical demonstration in Jameson's course took place in the field and in the museum, Jameson seeing both as sites for pedagogical purposes. Waterston argues that during

---

<sup>67</sup> NLS MS 3936 f. 65.

<sup>68</sup> For more on Jameson's use of the museum, see Chapter Four.

<sup>69</sup> Secord (1991a), 141, makes the point that young chemists also received no practical training at all. This improved after 1823 for experiments but Hope's flamboyant style and controversial discourse generally made his lectures more appealing to students than Jameson's dry manner.

Jameson's professorship, the museum of natural history was central to his teaching and the relationship of museums to university teaching underwent radical change during Jameson's tenure.<sup>71</sup> Like John Walker, Jameson made great use of the museum, opening it up as free to his students and, in some cases, spending hours there with them without assistance. Jameson's chief complaint to the Commissioners was that his students did not take enough advantage of the access he gave. The museum continued to play a major part in the practical side of Jameson's teaching. It is clear from his lectures on mineralogy that Werner's famous colour coding system was adopted as the most important mode of identification – a highly factual method.

Lastly, the most important practical teaching method that Jameson undertook was field excursions.<sup>72</sup> The neglect of Jameson's fieldwork in the literature is unfortunate given that he himself held it in very high esteem. There is no doubt that Jameson's use of the field technique also came from Werner. Abraham Gottlob Werner's mining school was founded on the formation of knowledge through practical activity and was manifest particularly in the execution of extensive field practices in Saxony, not only in the mines but also in observing the surface features and formations in and around Freiberg.

During Jameson's excursions, he would demonstrate to students the way to carry out investigations – including the examination of geological features. According to Laurence Jameson, the students went to the country 'round about' or to the Western Isles. According to the nature of geological detail he gave in his lectures, Jameson drew most of his empirical data from excursions to localities in and around the Edinburgh area. He particularly examined Salisbury Crags and Arthur's Seat, the village of Duddingston, Braid Hills and the Pentlands near to houses he owned at Roslin. There he showed his students how to examine appearances in the 'Mineral Kingdom', and point out interesting animals and atmospheric phenomena occurring. These excursions, considered Jameson, corrected any mistaken ideas that may have been formed in the

---

<sup>70</sup> Geikie A, (1924), 30.

<sup>71</sup> Chitnis (1968), 187. In Waterston (1997), 39.

<sup>72</sup> I will concentrate here on an explanation of his fieldwork as a teaching tool. For a discussion of Jameson's own fieldwork and travels exploits see chapter five.

classroom, and were used, therefore, as a form of corroborative and refutatory evidence. Furthermore they: “also prepare[d] for travelling and for the active and accurate pursuit of natural history”.<sup>73</sup> In their report, the University Commissioners in 1826 noted:

Although the professor is generally attended in his expeditions by the greater number of his pupils, no confusion arises. On the contrary the information is equally shared by all, and a universal feeling of satisfaction and delight is the constant result of these peripatetic exercises.<sup>74</sup>

In an anonymous obituary, a pupil wrote of the outings thus: “they did more toward the making of geologists than any instruction which has been given within the century”.<sup>75</sup>

Further:

During these Saturday expeditions he made the personal acquaintance of each student and amateur member of his class who displayed a knowledge or love for natural history. Friendships between professor and pupil then arose which eventually extended over years and led to a voluminous correspondence. His advice was eagerly applied for and regularly given, and many of the best scientific writings of his time owe some part of their excellence to his suggestions and revision. The men who became thus attached to him never forgot the college in which they had studied and from time to time sent valuable and interesting specimens and collections to be applied for by their old master to the development of the university museum.<sup>76</sup>

What of the Wernerian content of these tutored excursions? Despite his plutonic inclusions respecting veins by 1827-8, Jameson’s overall Wernerian explanations were thought appropriate for Salisbury Crags notably in respect of a belief that its apparent layered structure was thought proof that it belonged to the same formation and was deposited by water. According to Forbes, these fieldtrips were not specific to Wernerian theory. Rather, students were given a thorough grounding in all aspects of mineralogy, meteorology, vulcanism, the nature of springs and other physiographical studies.<sup>77</sup> A typical account of praise bestowed upon Jameson’s field excursions was that of James Cairns in 1817:

I have just received a letter from my nephew, James Cairns, a student attending your course on natural history; he states the pleasure and improvement he derives from your lectures; and above all from your excursions; certainly by far the best way of demonstrating nature’s works upon a

---

<sup>73</sup> *Evidence* 1, 142.

<sup>74</sup> *Evidence* 1, 138.

<sup>75</sup> Anon (1854), 574. Biography of the late Professor Jameson in *MJMS*.

<sup>76</sup> Anon (1854), 574. Biography of the late Professor Jameson in *MJMS*.

<sup>77</sup> Cunningham (1990), 14. Jameson’s interest in Snow and ice and glaciation grew considerably from the 1820s. Jameson gave regular courses on glacial topics.

grand scale; he says your course will finish about this month, I intend however, that he should remain in Edinburgh.<sup>78</sup>

Jameson's practical schemes for didactic purposes were even more elaborate than Thomas Hope's and particularly its merits, especially: "when the class appears to be composed of younger men".<sup>79</sup>

Jameson adopted a multitude of methods and techniques in his teaching which was not just confined to the classroom. As I shall show in chapter six, however, Jameson did not openly embrace every form of practical learning. He never, for example, endorsed the use of chemistry or laboratory experiments to verify Wernerian theory. Jameson's own thoughts about chemistry as a separate entity to natural history were made clear to the Commissioners concerning the museum:

Do you see any objections to students of chemistry, or others who might not be here for many years, having the use of the museum in the same as the students of your own class? – I should think that they ought not.<sup>80</sup>

Changes that took place in chemistry and its usefulness during Jameson's professorship was also discussed by Wilson:

A reference indeed to chemistry may close this section. Jameson had heard the last dying echoes of the battle between the partisans of the phlogiston and anti phlogiston camp. He had long ended his chemical studies before the names of Galvani and Volta had been heard of in England, or the Voltaic battery had been invented. The whole of Davy's career was within his cognizance. Dalton's atomic theory slowly struggled into acceptance under his eyes. Berzelius revolutionised before him the entire chemical department of mineralogy. Mitscherlich established a connexion [sic.] between crystalline form and chemical composition; and organic chemistry changed from a crude system of drug making into an elaborate storehouse of essential bases, acids, and other principles, and became as we have seen under Botany, as perfect in its analyses and system, as inorganic chemistry had already become.<sup>81</sup>

Jameson was not the only professor in the university with geological interests even if he was the individual with official responsibility for teaching it. John Playfair, professor of mathematics, and John Leslie, professor of natural philosophy, also had strong interests in geology - and in particular, allegiance to Hutton. Chemistry professors from Black to

---

<sup>78</sup> EUSC Gen. 1999. James Cairns to Jameson, July 7, 1817, London.

<sup>79</sup> *Evidence* 1, 146.

<sup>80</sup> *Evidence* 1, 492.

<sup>81</sup> Geikie and Wilson (1861).

Hope took a keen interest in matters geological.<sup>82</sup> In highlighting differences in method, and strengthening the claim of this thesis, Secord notes differences in method between Jameson and Hope's courses. Jameson's course provided pupils with extensive experience in the museum, the field, and the meeting room, and Hope offered his aspiring young chemists no practical training at all. Despite this lack of practical training, Secord argues that the flamboyant style to Hope's teaching, and Hope's emphasis on causal explanation appealed more to the young Darwin than the dry-as-dust description of external characters of minerals.<sup>83</sup>

It is easy to understand why there was so much interest from professors in other disciplines. The broad 'philosophical' nature of Scottish education made boundaries less important and natural history and geology more than mathematics and, possibly, even than chemistry were deemed popular and appealing to the public.<sup>84</sup> But they did not teach geology and direct comparisons cannot, therefore, be drawn without difficulty. Their methods, as Huttonians in their respective fields, were different to Jameson's, as I show below.

### 3.3 Conclusion

In trying to impart a clearer understanding of the nature of Jameson's Wernerianism in the classroom, I have shown that Jameson's early tenure as professor was paradoxical and complex. Whilst addressing theoretical issues in the same way that his society displayed, they did not dominate his lectures and were not delivered via use of analogy. In mineralogy Jameson lectured as a Baconian, using the descriptive tool of external character. In geology, whilst advocating the notion of 'formations' his lectures were mostly factual in content.

Despite a dryness of manner and a descriptive approach to teaching, Jameson's course was still held in high regard by interested naturalists, worthy, according to some, of the status of 'founder of a school'. Well respected generally amongst scientists of his

---

<sup>82</sup> For more on the geological contribution of Thomas Hope through chemistry in opposition to Jameson, see chapter six.

<sup>83</sup> Secord (1991a), 141.

day, the course did not adhere to chemical techniques and refrained, too, from practical classroom demonstrations. Jameson used the field for practical instruction, pioneering its use for geological purposes in Britain as Werner had done for Saxony.

Whilst never openly abandoning Wernerian principles, Jameson rarely resorted to any speculative discussion about geological theory. In his later years, and certainly after 1835 when his syllabus changed, when he taught theory, he included both Wernerian and Huttonian perspectives, using evidence in a Baconian sense. Jameson gradually incorporated more igneous concepts into his Wernerian schema, eventually abandoning the Wernerian term 'geognosy' altogether from his lectures in 1831. Despite this, student notes show that from 1804 to 1831 the overall syllabus of Jameson's lectures changed little. Whilst not fully abandoning Wernerian teaching, he did make minor modifications with regard to the geology section becoming over time demonstrably less militant in terms of adherence to Werner's doctrines.<sup>85</sup>

A study of Jameson's teaching style and methods reveal much about the true nature of his Wernerianism. I have shown that in the presentational space of the classroom, it is necessary to rethink the label of Jameson as active militant promoter of that theory and of his contributions in debate. I have shown that the relationship of Jameson to geology is far more complex than an a mere essential Wernerianism as it relates to his theoretical side, and that the nature of his natural knowledge enquiry must be rethought as existing, largely, in a different intellectual context to Huttonian proponents. In the next chapter, I will discuss how Jameson used the museum and show that geological theory *per se* and conflict over it do not play as large a part in Jameson's agenda in respect of the museum as has been commonly assumed.

---

<sup>84</sup> Golinski (1992).

<sup>85</sup> See Appendix 3. Syllabus post-dates 1835.

# 4

## DISPLAY: MUSEUMS AND MINERAL COLLECTIONS

### 4.1 Introduction

Museums in many contexts have been of interest as settings for scientific activity and the shaping of scientific knowledge.<sup>1</sup> This chapter builds on previous assessments of Jameson by discussing his museum curatorship and the implications an understanding of it has for Jameson's role in geological discourse. The questions advanced here include how Robert Jameson used and valued the collections, and the implications his management had for the role of the museum in dispute over geological theory.

Museums housing all kinds of curiosities, from antiquarian artefacts, works of art and natural history and general curiosities, have been products of Edinburgh civic culture since the sixteenth century.<sup>2</sup> According to Laurence Jameson, the earliest moves towards a museum of natural history in Edinburgh were made by Sir Andrew Balfour in 1694, "in the 63<sup>rd</sup> year of his age, and [who] bequeathed his extensive collection to the University of Edinburgh".<sup>3</sup> This was supplemented by Robert Sibbald in 1697.<sup>4</sup> Robert

---

<sup>1</sup> Recent study on this theme is extensive: see Bennett T (1995), Bennett in Macdonald (ed.), (1998). Renoir and Lynn-Ross (1996), Galison and Stump (eds.), Bud (1995), 1-17. Other useful studies are Kohlstedt's essay review, *JHB* Vol. 28, 151-156, Allan (1993), (1996), Hartley (1996), and Waterston, (1997). See also Smith, Forgan and Gooday, Pyenson and Sheets-Pyenson (1999), 125. As a contemporary definition Waterston, in consulting the Chambers *Twentieth-Century Dictionary*, defines a museum in its simplest form as a 'collection of curiosities'. Webster's college dictionary defines it in a more situated sense as 'a building or place where works of art, scientific specimens or other objects of permanent value are kept and displayed'. Geddie (1959) suggests that its specific definition is an 'institution or repository for the collection, exhibition and study of objects of artistic, scientific, historic or educational interest'. It is a 'place of study; a resort of the learned'.

<sup>2</sup> On Museums of General curiosities see Taylor (1992), 153-167.

<sup>3</sup> Jameson L, (1854), 32.



Ramsay was appointed to the curatorship and chair of Natural History in 1767.<sup>5</sup> His death in 1775 gave rise to conflict about succession between John Walker and William Smellie.<sup>6</sup> Walker emerged triumphant and took up the keepership in 1779 where he remained until his death in 1803.

Jameson became keeper in line with his chair in 1804 and faced a difficult task from the outset. With little or no money but his own, and the removal of almost the entire collection by Walker's trustees, Jameson had to build a collection from humble and meagre beginnings: (as, indeed, had Walker with the Balfour/Sibbald collection). Jameson undertook this challenge with vigour for the next fifty years.

## 4.2 Proprietary Concerns and Museum Impropriety

Jameson's museum was no stranger to controversy, owing, in part, to the great number of changes taking place in the sciences in the early nineteenth century. Wilson and Geikie made this point in a tribute to Jameson shortly after his death in 1861:

It would be doing Jameson great injustice to impute to him any active opposition to the changes which now began...he was no enemy to progress. He had witnessed so many revolutions and so many silent progressive changes in science, that to learn of a new one could not startle him... An eclectic not a dogmatist; a critic and expositor rather than an originator; and a wide and diligent reader of the current scientific literature, he had, all his life long been like one afloat in a discovery ship on a mighty unknown river.<sup>7</sup>

The proprietary nature of Jameson's keepership is not fully understood and has, I argue, been represented too simplistically.<sup>8</sup> Studies by Eyles and Chitnis preclude a fuller picture by concentrating on events relating to geological controversy over theory with great use made of accounts given 'against' Jameson in the Universities, Commission Report, 1826-30.<sup>9</sup> I want to provide at least a partial redressing of the argument by

---

<sup>4</sup> The Museum's early history is discussed in Waterston (1997), 13-15 and Withers (1992), 289-291.

<sup>5</sup> Kerr (1811), 1:88, in Withers (1992), 290.

<sup>6</sup> Withers (1992). See also Scott (ed.) (1966), *Introduction*.

<sup>7</sup> Wilson and Geikie (1861), 115.

<sup>8</sup> Eyles (1954), Sweet (1970), (1972), (1976), Waterston (1997), Chitnis (1970), Jameson L (1854).

<sup>9</sup> I could also be answerable to the charge that Jameson's testimony was also biased, but by setting the claims in their intellectual context and backed up by references from other sources, I hope to have addressed at least some of the problems of relying on personal testimony for an accurate picture of motive.

concentrating on an analysis of Jameson's testimony (although subject to scrutiny itself) to the Commissioners in 1826 and not just the Huttonian complaints levelled against him.<sup>10</sup>



Figure 2. The College Museum of Edinburgh, opened in 1820. Jameson's mineral collections were in the glass cases. Printed by permission of Edinburgh University Library.

This emphasis on Jameson's refusal of access in the context of arguments surrounding Huttonian geological specimens has led to misinterpretations about how Jameson used the museum, and consequently, the precise form his Wernerianism took. Yet whilst Wernerian theory played a part, I shall argue that it was not the major consideration. A re-examination of Jameson's keepership in a broader context - not just concerned with geological theory - gives a more accurate picture. The issue of refusal to collections must

<sup>10</sup> Whilst I shall use the Report, as I have for accounts of Jameson's teaching methods and style, I will here add evidence in support of the statements made. Although a highly useful information source the 1826 Report displayed biased accounts based on frustrated individuals whom had been denied permission to collections. It has therefore to be used with care. Sweet (1976) *xviii*, in Jameson [1976] also makes the point about its over-use in the few accounts of Jameson's keepership. She states: "Some of the statements from witnesses were distinctly biased as they had not, for various reasons, had permission to examine specimens. However, on the whole Jameson came out well from the investigation. It is unfortunate that some people, even recently, have taken all their information about Jameson and his work from this published report".

also be understood as a wider, more general policy of exclusion, not just relating to geology. I shall argue that Jameson's decision to refuse Huttonian scholars was based less on the grounds of geological theory and was, rather more, a matter of proprietary and political concerns.

Understanding the nature of display further illustrates this claim. I show that the layout of geological and mineralogical displays were not designed to provide any theoretical proof but were based rather on descriptive elements and external characteristics. As I have already shown for the Wernerian Natural History Society, Jameson and his colleagues rarely used it actively to promote Wernerian theory. In a museum context, Wernerian theory, although present, also formed less of a central role in any explanation of his actions and conduct.

#### 4.2.1 Jameson's Proprietary Nature: Collection Building

When asked by the Commissioners in 1826 how much of the museum collection had been formed since his appointment he replied:

The whole I may say, When I succeeded to the late Dr Walker there was a considerable collection in the room, that collection was almost entirely removed by Dr Walker's trustees. I had no power to interfere; it was carried away as his private property.<sup>11</sup>

In 1804, the situation was very different. Jameson had built up a substantial collection by 1826. Issues surrounding the ownership and possession of the property were foremost for Jameson and understanding these issues help illustrate the reasons for Jameson's policy of refusal of access.

The Museum first gained credible public appeal through the work of John Walker. Recognising the museum as his own, Walker relied upon his personal collection to advance these ideals. He stated in his lectures, "I must therefore content myself with having recourse to my own little private collection which tho' considerable enough for my opportunities, yet is altogether inadequate".<sup>12</sup> Despite the private nature of the collection, it was Walker's desire to present the collection to the public good by

---

<sup>11</sup> *Evidence* 1, 142.

<sup>12</sup> In Scott (1966), (ed.), xxvii.

displaying many items and often using the materials to assist with his classwork.<sup>13</sup> In praise of these efforts, an anonymous author wrote:

A few years ago there was not in this place [Edinburgh] a single collection of specimens of natural history, public or private, that deserved to be noticed. Since Dr Walker was appointed professor, and read lectures on the subject, things have taken a great change. His own museum, for a private collection contains a great variety of beautiful specimens in high preservation, of animals, vegetables and minerals.<sup>14</sup>

Walker's attempts to build a museum of reputable size and stature were successful. His private collection was large, having a laboratory equipped with 3000 specimens representing over 1500 species of rocks and minerals possibly second only in size to Werner's Freiberg collection at the time.<sup>15</sup>

However, Walker's success in bringing about his private collection for public and teaching purposes also caused many of Jameson's early problems. Trustees removed most of Walker's collection after his death, leaving Jameson to uphold the museum's reputation with meagre financial resources at his disposal. Jameson was left with the difficult task of acquiring new material as he informed the Royal Commission in 1826:

The portion left for the museum was very small and there was now scarcely anything left, nearly the whole of the collection having been thrown out. A few things were kept for a year or two; they gradually gave way, in consequence of having been badly prepared. There [were] a few rocks, and articles of Indian dress which still remained, the only articles left of any consequence.<sup>16</sup>

The difficulties of using privately owned collections for public display became all too apparent to Jameson when faced with upholding a reputation with depleted resources. Jameson was keen to make sure that items remain publicly owned. He upheld the belief that the collections on display were and should be public. When asked by the Commissioners in 1830 about whether items were considered to be his private property Jameson was clear: "No – I believe the principle is, that all property within the walls of the museum is considered, as long as it is exhibited there, public property".<sup>17</sup>

---

<sup>13</sup> Withers (1992), 289, shows that Walker's emphasis as museum curator was reflected in the collection displays as a utilitarian science with knowledge arrived at through empirical study. For more on Walker's natural history, see Withers (1989), (1991).

<sup>14</sup> Anon (1792), 132, in Waterston (1997), 40.

<sup>15</sup> In Scott (ed.), (1966), xxviii.

<sup>16</sup> In Jameson L (1854), 35.

<sup>17</sup> *Evidence* 1, 632.

Jameson knew that it would take many years to rebuild the collection without adequate funds. He gradually set about accumulating fresh material from small donations of former pupils and foreign donors. This however, proved to be too little. For substantial improvement more funds were needed for a task of the magnitude of Jameson's. The first breakthrough came in 1807 when he obtained Treasury permission to circulate to Crown officers in all foreign dependencies of the Empire printed instructions for collecting natural history specimens.<sup>18</sup>

Between 1804 and 1812 the cost of curating the Museum was paid partly by the town council and partly by Jameson himself.<sup>19</sup> In 1812 the management of the Museum underwent complete revision. Jameson built a collection of a size that warranted larger sums of money than current authorities were willing to grant and so he earnestly appealed to the Crown for more funds. By this time he was able to demonstrate a collection that consisted of 2290 specimens of quadrupeds, birds, fishes, reptiles and insects and about 19,000 specimens of rocks and minerals. Obtaining these had incurred considerable personal expense. In their report of 9 July 1812, the Barons admitted that Jameson was in need of more funds:

In the month of February 1812 Robert Jamieson [sic] Regius Professor of Natural History and keeper of the Museum presented an application to the Lord Commissioners of the Treasury praying an increase of salary and which was remitted to the Right honourable the barons of Exchequer, who on the ninth day of July thereafter among other things reported; "Mr Jamieson also prays your Lordships for a salary as keeper of the Museum. Upon enquiry we find that there are certainly expenses attendant upon the museum, which we conceive to be reasonable that the public should defray. It is necessary to have an assistant skilled in the art of stuffing and preserving the different objects of natural history, and to whom Mr Jameson at present has to pay an annual sum. There are besides considerable expenses incurred in the carriage of packages and other outlays, which owing to the general diffusion of Natural History are rapidly increasing...we are humbly of the opinion that it would be proper to raise it to £100 per annum".<sup>20</sup>

After difficult negotiations, Jameson managed to secure extra funds to the sum of £100 per annum for expenses incurred in the Museum's preservation, and for the purchasing of specimens.<sup>21</sup> The money was a huge boost, and was probably a factor in Jameson not

---

<sup>18</sup> In Eyles (1954), 161.

<sup>19</sup> In Eyles (1954), 161.

<sup>20</sup> Catalogue of the Museum of the College of Edinburgh book of reports, no16. Excerpt from report of the Barons 9 July 1812.

<sup>21</sup> EPL. Edinburgh Museum Register Vol.1 (1812). Preface by Robert Jameson noting an Extract from the Kings Warrant. In the name, and on behalf of His Majesty George, Prince Regent.

taking up the position of Professor of Mineralogy to the Royal Dublin Society, which he had been offered with an additional £600 annually for the up-keep of its museum.<sup>22</sup> In a draft letter of 5 March 1812, he expressed his pleasure at having secured the extra funds, and at not having to cover heavy costs from his own private expenses:

Dear Sir, When you see Mr Jardine tomorrow I beg you would state to him that I had relinquished my Irish appointment on the expectation of a favourable answer being returned to my petition....In the commission it is also stated that I may draw on the exchequer to the amount of £100 annually providing I present accounts and documents. This is no addition to me, but will be of service to the Museum and I feel grateful to the government for this mark of their liberality. It is true it will ease me of annual expenditure from my own private funds; I had intended to support the public museum out of my own pocket.<sup>23</sup>

After 1812, and with a still a sizeable portion of his own funds going into the Museum's up-keep, the collections began to build in parallel with the reputation of Jameson.

Another important concession was obtained from the Treasury in 1819 which sanctioned the import of specimens for the museum on a duty-free basis. This allowed Jameson to acquire one of the largest collections from a single donor, the specimens of French naturalist, Louis Dufresne (1752-1832).<sup>24</sup> The collection was purchased for the sum of £3000 and contained upwards of 20,000 specimens, mostly of zoological interest.<sup>25</sup> Another collection, mostly ornithological, was obtained from William Bullock after Sir Joseph Banks had requested that he had no need of them. It was purchased with £500.<sup>26</sup>

By 1826 Jameson reported to the Commissioners that he had filled the great halls and galleries of the West Museums with new objects, as well as five galleries of the East

---

<sup>22</sup> EUSC Gen. 1999. [n.d.] Letter of Robert Jameson to [?] about the relinquishing of his Irish appointment as Professor upon hearing the news of extra funds for the Edinburgh Museum.

<sup>23</sup> EUSC Gen. 1999, 14.

<sup>24</sup> The lengthy correspondence (86 letters) about the acquisition of the Dufresne collection can be found in EUSC Gen. 1808/2. The collection forms a large part of Sweet (1970), 33-71. The Dufresne collection was one of the largest single collections Jameson ever acquired. In later years he also received another huge collection this time from a William Bullock (1820) that, although highly significant, is not fully relevant to the discussion of Jameson's museum before 1826.

<sup>25</sup> Eyles (1954), 161.

<sup>26</sup> The William Bullock correspondence concerning the sale of collections is in EUSC Gen.1801/1.

Museum.<sup>27</sup> According to Jessie Sweet, the number of specimens in 1812 was 21,619 and at the time of Jameson's death in 1854 it had increased to 74,453.<sup>28</sup>

Laurence Jameson stated in 1854 shortly after Jameson's death, "In short, the whole comes to this, that the present Museum was founded, created, arranged and exposed for public exhibition by the head and industrious hands of one man – Jameson".<sup>29</sup>

Given this set of circumstances, there is little wonder that proprietary issues were of such importance to Jameson, despite his desire for collections to remain public. Though not directly owning it, he became very concerned about who would have access to the collections.<sup>30</sup>

#### 4.2.2 Museum Access: Working Conditions and Scientific Reputation

In the face of competition from abroad and at home, proprietary concerns involved the need to prevent potential rivals wanting to set up their own museums or scrutinise Jameson's.<sup>31</sup> After all, a museum in a depleted state with descriptive outdated displays could tarnish Jameson's reputation and make way for others to apply for funds in order to set up their own enterprises. With this in mind, the whole question of access to Jameson's collections is in need of further investigation.

Jameson made no secret that a good reputation was paramount. He pointed this out to the Commissioners very clearly: "If therefore I allow drawings and descriptions to appear as from the Museum, which are unscientific, the character of the keeper, as a man of science, is in hazard".<sup>32</sup>

This was also the case for geological collections. Waterston (1997) shows that Jameson's intransigence in refusing access to the Hutton collection was interpreted by

---

<sup>27</sup> In Jameson L (1854), 34.

<sup>28</sup> Sweet (1976), fn. 42.

<sup>29</sup> Jameson L (1854), 35.

<sup>30</sup> 'Phrenology and Professor Jameson' in *PJ* 1 (1824), 56. Desmond and Moore (1991), 42 and fn. 25. Charles Darwin's friend at Edinburgh added testament to Jameson as having a despotic manner in this respect. With regard to his Museum collections he was dubbed an "absolute dictator".

<sup>31</sup> This is particularly true in the case of the James Hutton's collection.

<sup>32</sup> *Evidence* 1, 492.

some contemporaries as Wernerian prejudice.<sup>33</sup> I intend to show that this was not the reason. Before I encounter the issue in relation to geological collections, however, I will outline the foundations behind Jameson's refusal that do not hinge on geological theory.

Further testament to Jameson's believed ownership was the fact that he was always open about his policy of refusal. In his second examination by the University Commissioners on May 14 1827, he was asked to answer questions about refusal of admission to collections: "Have any instances occurred of persons having made such applications, whom you refused"? Jameson's reply was short and swift: "Yes – often".<sup>34</sup> This was not unique to geology but applied to scientists of all guises and persuasions representing many nationalities.

The Commissioners were so concerned about this that the Earl of Rosebery [sic] recalled Jameson for further examination in 1830, this time with specific instructions to answer questions relating to the access of scientific persons:

In the name of the Commission for visiting the universities in Scotland I take the liberty of requesting that in conjunction with principal Baird, Dr Alison, and Dr Hope (to each of whom I have addressed a letter) you will have the goodness to frame such a set of regulations for the introduction of scientific persons to the museum in this university as may appear to you and them jointly, the best calculated for their admission to it, with as little degree of restraint as is consistent with the safety of the various articles deposited there.<sup>35</sup>

Jameson seemed undeterred and certainly not threatened by this and was happy to appear at the interview. Again, Jameson's reason for the general refusal was based on his perception of reputation:

If I think they are not likely to do credit to the establishment, I refuse permission. Again if the application is made by persons at a distance I ascertain as well as possible whether they are likely to do credit to the establishment and if so, I grant permission and if not I refuse the application.<sup>36</sup>

Jameson's precise meaning is difficult to ascertain. It may have had a bearing on upholding the *reputation* of the museum in a European context, another reflection of the way 'scientific reputation' played a role outside of Wernerian theory. Fearing reports that old and ill-kept specimens might in fact damage his standing, access was denied.

---

<sup>33</sup> Waterston (1997), 43. The claim refers in particular, to Chitnis (1970).

<sup>34</sup> *Evidence* 1, 491.

<sup>35</sup> EUSC Gen. 1999. Earl of Rosebery [sic.] to Jameson, 18 August 1827.



Other problems Jameson had were practical. He had neither sufficient space to accommodate applicants, nor sufficient staff to sit with them. He often complained of this. When the Commissioners asked about ways in which specimens were handed to applicants, Jameson replied:

At present I have no rooms proper for the purpose, and they are taken to the classroom. Drawing at present is inconveniently circumstanced, both on the score of want of room, and the necessary attendants...many accommodations are required for drawing and also the constant attendance of a person or persons to see that no harm comes to the specimens. In short, opening the Museum generally for drawing and exhibiting specimens would entail on the establishment a large annual additional expense.<sup>37</sup>

Jameson suggested that permission be granted to those who he could be assured were conducting works for the purpose of 'self improvement' only, further confirming how important reputation was to him. Jameson told the Commissioners: "If they intended to publish I would not allow them on any account; as the reputation of the establishment might be effected by the publication of disreputable work".<sup>38</sup>

Another reason for refusal was based on the lack of staff. Jameson made an issue to the Commissioners about this, as a consequence of insufficient funding. When asked about funding, Jameson had no hesitation in making clear what he considered to be a most pressing issue:

We have some returns from the college, and from you, relative to the Museum but we wish a little more explanation with regard to the state of the Museum; and, in the first place have you anything more to state yourself farther than what appears in your returns on the former examinations? – I intend to state the absolute necessity for some fund being provided for the collection.<sup>39</sup>

As much can be learnt about Jameson's motives by looking at whom he allowed to enter as by those he did not.<sup>40</sup> It must not be forgotten that Jameson granted permission for scholars to enter the museum on a regular basis, some of whom were not self-professed

---

<sup>36</sup> *Evidence* 1, 491.

<sup>37</sup> *Evidence* 1, 491.

<sup>38</sup> *Evidence* 1, 492. Jameson did not say exactly what he meant by 'unscientific character' in the Commissioners' report. Whether or not he was referring to conduct not befitting a Wernerian or whether it was a statement as to the general reputation of the particular individual, is not clear. One thing that is certain however, is that this statement adds further weight to Jameson's concern for the *reputation* of the museum be of the highest standing possible.

<sup>39</sup> *Evidence* 1, 490.

<sup>40</sup> It also serves another purpose as the first study that does not concentrate only on instances of his refusal.

Wernerians. Jameson gave many reasons for access, listing examples to the Commissioners:

I shall mention, with your permission, the names of some individuals to whom this favour was granted. Mr Selby, a distinguished naturalist in the North of England, who was here on a visit, was admitted in that way. He was about to embark in a great work on the birds of Great Britain and requested admission to make drawings from specimens in the museum. At once knowing his reputation, I granted the liberty he desired. Afterwards, colonel Smith, a distinguished observer and draftsman requested permission to make drawings from specimens in the museum, which I allowed; and since the he has made use of them in some very interesting works. About two years ago Sir William Jardine, a former pupil of mine, made a similar application; and it was granted... Since this application, another of my pupils, Mr Wilson, a brother of Professor Wilson solicited a similar position to make drawings; and this, from the known talent and high accomplishments of that Gentleman, was granted... I may also mention that, occasionally, members of the Royal Society of Edinburgh have asked permission to make drawings, which I have granted; and such have been published in the transactions of the Royal Society. Members of the Wernerian Natural History Society, in the same way, have been permitted to make drawings from objects in the museum when the keeper judged it right and proper.<sup>41</sup>

Permission was not just granted, however, to scholars of his choosing. The Museum was open to all who undertook Jameson's natural history course for a guinea a year and to members of the Wernerian Natural History Society. This included complainants like Sir George Mackenzie. Ironically, Jameson's chief concern was not that he had to deny requests, but that it simply did not get used enough. When he was asked if students from other courses, other than his own, be allowed access, he replied: "I should think not. I have experienced from my own class the students of which have gratuitous admission to the Museum, and sometimes not more than half of them take advantage of it".<sup>42</sup> General public access was made for those who paid a set fee of 2s. 6d.<sup>43</sup> This sum seemed to bring in about £500 per annum with an annual expenditure of £700 according to Jameson's calculations.<sup>44</sup>

So far I have established that *intellectual concerns* over the credibility of the intending user, his students and the public demonstrates that refusal of access was not based on Wernerian grounds. I will now show how the nature of display itself provides further evidence.

---

<sup>41</sup> *Evidence* 1, 491.

<sup>42</sup> *Evidence* 1, 492. See also chapter three.

<sup>43</sup> For more on this see discussion on entrance fees in *Evidence* 1, 490.

<sup>44</sup> In 1834 the Town Council reduced this admission fee to one shilling and in 1839 it was proposed to reduce it still further to sixpence. This attempt at popularisation does not seem to have been carried out and the price was kept high. For a discussion see Eyles (1954), 161.

### 4.2.3 Arrangement: The Nature of Display

In his ‘Lectures on geology’, John Walker made no secret of his views about geological theory: “I would not wish to deliver anything like theory, but merely a natural history of the earth”.<sup>45</sup> This Baconian approach was most reflected in the layout of collections under his curatorship. Withers has noted that these elements formed the mainstay of Walker’s display philosophy:

The emphasis given by Walker to the subject in his university lecture classes and in his Museum curator-ship was on natural history as a utilitarian science, and on a knowledge arrived at through empirical study.<sup>46</sup>

I shall show that there is ample evidence that Robert Jameson inherited Walker’s methods. Jameson’s specimens were not arranged to favour any theoretical cause, and certainly not in order to demonstrate ‘proofs’ of Werner’s theory.

Professor George Wilson, in writing about Jameson’s successor Edward Forbes, gave a lengthy account of the nature of Jameson’s collection in the Museum describing it as “highly instructive” but not without defects.<sup>47</sup> Wilson went on to say that the greatest deficiencies existed in the geological collections:

Great deficiencies, moreover, existed in it. None perhaps, was more remarkable, considering the splendour of the mineralogical collection, than that shown in the case of geology. Some specimens of rocks and fossils there were, but no series of illustrations representing the stratigraphical, palaeontological, or industrial relations of the several geological formations. The student was not furnished with the means of familiarizing his eye with the lithological or mineralogical characters of even the igneous rocks, still less with those of the sedimentary strata. No systematic collection existed of the fossils which so strikingly characterise the majority of the aqueous rocks. Nor was there any provision in the way of drawings, diagrams, models, classified ores, slags, metals, and the like, to enable the mining engineer to learn how and where to look for coal, for limestone, black-band or lead ore, and how to recognise them when he encountered them.<sup>48</sup>

Jameson’s geological collection appeared ill equipped adequately to demonstrate any theoretical position, never highlighting external characteristics. During the nineteenth century where demands for specialised knowledge and for artefacts to be used as tools

---

<sup>45</sup> In Scott (ed.), (1966), 181.

<sup>46</sup> Withers (1992), 289.

<sup>47</sup> Wilson and Geikie (1861), 111.

<sup>48</sup> Wilson and Geikie (1861), 111/2.

for ‘representation’ increased, Jameson’s ‘descriptive’ displays based on external characteristics became an increasing source of frustration to many scientists.

According to Wilson’s testimony, Jameson displayed geological collections according to the empirical Baconian schema, never deviating from it. Wilson, having heavily criticised Jameson was also sympathetic to the restrictions imposed and difficulties he would have had in making changes, further strengthening the argument of reputation:

It would have been the height of folly to complain that these geological desiderata, as yet but very partially possessed by us, were not attained in any degree, quarter of a century ago. Jameson could not have got them, whatever efforts he had made. Directly he perhaps made no efforts, but indirectly he trained or influenced the men, who, like Edward Forbes, have changed our Museums from sepulchres, sacred to death and silence, into temples where the Pythoness is always present, and always inspired, and the oracle is never ambiguous.<sup>49</sup>

The *nature* of the display was further testament to the utilitarian and descriptive way Jameson chose. Wilson even suggested that mineralogy, being the special preserve of Jameson, was represented solely by specimens in their natural condition, rather than by their crystallographic, optical or chemical properties or by reference to the industrial uses of the minerals.<sup>50</sup> Other collections were also displayed according to a descriptive Walkerian system. Observers noted that invertebrate animals had no visible recognition in the collection with no mention made of internal structure or anatomy:

The millions of sea creatures, of lower grade than fishes, which Edward Forbes made his special study, were acknowledged as worthy of admission only in so far as they left behind them, after death, shells of sea marble or of mother of pearl, which were as beautiful and as lasting as minerals. Of no class of animals, moreover, high or low, was there any series of specimens illustrating its internal structure. Skeletons; separate organs and dissections of important tissues preserved in spirits; enlarged models of minute structures; microscopic sections; diagrams and drawings were almost totally wanting.<sup>51</sup>

This led them to conclude that Jameson’s museum although a testament to its time reflected a very outdated mode of display, more akin to late eighteenth-century taxonomic thinking. They concluded:

---

<sup>49</sup> Wilson and Geikie (1861), 112.

<sup>50</sup> Wilson and Geikie (1861), 112.

<sup>51</sup> Wilson and Geikie (1861), 113.

In a word, the natural history of Edward Forbes's novitiate and Professor Jameson's prime, was too much, so far at least as taught, a science dealing only with external characters. The density, hardness, colour, lustre, crystalline form and one or two other sensible properties of each mineral were carefully noted; the chemical composition was recorded with little or no commentary and there the enquiry ended, and the mineral was assigned its place in a system. The great majority of the animal specimens were simply stuffed skins. Of some creatures there were only skeletons....in the estimate of even of the educated, the prevailing notion of a naturalist was one who knew by sight, and could draw, describe, and classify a great number of rocks.<sup>52</sup>

This does not seem, on the surface, like a museum display that demonstrated Jameson's Wernerian theoretical views. According to this, the display structure suggests something rather different, certainly in terms of the *use* of display. Wernerianism was not on show even though it was known:

They [naturalists] knew that systems of classification were to a great extent only matters of convenience, and that they had a scientific value in so far as they recognised all the affinities, analogies, and relationships which linked together the objects of classification. But they felt this more fully than they expressed it, and the majority of their hearers did not perceive that they felt it at all.<sup>53</sup>

Specifically concerning Jameson in this context, Wilson wrote of him:

Jameson begat a love of natural history in his students which could not be fed upon dried skins and glass eyes, or arrangements of living creatures in artificial groups as little true to nature, in many cases as those in which children rank the contents of Noah's ark.<sup>54</sup>

According to Wilson and Geikie, who as youngsters had themselves experienced Jameson's museum at first hand, the impression was clear, that by the time of writing, they viewed Jameson's displays as antiquated, outmoded and outdated, a reflection of Baconian description, and not of any great explanatory merit.

The specimens of rock, as display, were not used as Chitnis has suggested as a 'weapon in the struggle' [with Huttonianism] but instead were characteristic of a factual or descriptive approach that did not advocate any instrumental use of the specimen except its external characters.

Proprietary concerns, scientific reputation and economic competition all played a part in shaping Jameson's decisions to refuse access to collections. With that in mind, I shall now discuss Huttonian rock collections in Jameson's possession.

---

<sup>52</sup> Wilson and Geikie (1861), 113/4.

<sup>53</sup> Wilson and Geikie (1861), 114.

### 4.3 Biased Rocks: Jameson and Huttonian Collections

Shapin (1971) and Withers (1992), has shown that before Jameson, the ownership of cultural property and the struggle for political patronage was no new thing.<sup>55</sup> In the same context, he has also pointed out that what fired disputes was the nature of collections and type of natural history and the purpose to which that natural knowledge was to be put.<sup>56</sup>

Could the same be true of Jameson? Jameson's concern for the setting-up of rival museums was a reflection of the nature and type of geology but for empirical reasons rather than as is commonly mistaken, strictly theoretical. He knew that his rivals wanted to demonstrate tenets of the Huttonian theory in the rocks, but it is less convincing to suggest that it was motivated solely for theoretical reasons.

Although Jameson was a Wernerian theorist, his mineralogical leanings and factual philosophy of display show that he did not choose to use his collections of rocks as tools for theoretical advancement.<sup>57</sup> In the context of Huttonian collections, it may be possible to impute Jameson's refusal to display the rocks on the grounds that he was a Baconian than because they promoted Hutton's theory. This was not a theoretician objecting to a *rival* theory, but a Baconian objecting to a 'false' methodology.

Jameson's many other acts of impropriety in the museum further demonstrate the treatment of the Huttonians as but one instance in a *general* policy of exclusion that encompassed requests to view all parts of the natural history collections.<sup>58</sup> The fact that this action did not just confine itself to geological issues is further evidence that personal reputation prevailed as an issue of importance over Wernerian theory.

Now that I have discussed and gathered evidence in favour of Jameson's impropriety as a combination of political and proprietary concerns, I will go on to consider how this came about with regard to geological collections that purported to demonstrate and promote Huttonian theory. Rather than be a forum for debate, as

---

<sup>54</sup> Wilson and Geikie (1861), 114.

<sup>55</sup> Withers (1992), 289-303. Withers argues this point with respect to the Walker-Smellie debate.

<sup>56</sup> Withers (1992), 289.

<sup>57</sup> Sweet (1972).

<sup>58</sup> *Evidence* 1, 492.

Chitnis has suggested, Jameson tried to contain Huttonians from publicly promoting a theory by a means he believed should not be used for such purposes – the use of specimens.<sup>59</sup>

The two collections in question with Jameson possessed were James Hutton's which comprised some 720 rocks,<sup>60</sup> and a set of 300 rock samples from Sir George Mackenzie's voyage to Iceland in 1810. Each collection found its way to Jameson under an RSE charter still in place from its inception in 1783. Both collections were never displayed in Jameson's Museum with access often denied or discouraged to Huttonians wishing to inspect them. The incidents surrounding Huttonian property viewed in this wider context of proprietary concern gives a clear indication of the precise nature of Jameson's Wernerianism as a form of 'resistance' to an onslaught by Huttonians (members of the RSE). Jameson did not use specimens to 'radiate' proof of Wernerianism in the same way Huttonians used their specimens to provide proof of Huttonianism.<sup>61</sup>

### 4.3.1 James Hutton's Collection

Sir Joseph Black donated Hutton's specimens to the College Museum of the University on 2 December 1799. Along with this donation came a set of conditions as requested by Hutton's family:

The conditions and restrictions which I beg to leave to propose are the following. 1) That the articles of this collection shall not be separated from one another or dispersed among the specimens of the museum but shall be preserved as a distinct collection having the name of the Huttonian collection of Fossils. 2) That they shall be committed to the custody of the professor of Natural History, the professor of Chemistry and two other persons elected by the physical class of the Royal society with liberty to lag them open occasionally to the inspection of intelligent persons who may desire to examine them. 3) That the society will have the specimens marked with numbers or otherwise and shall provide chests of drawers or any other more convenient repositories for them in which the place of each specimen shall be marked with the same number or other mark as the same specimen which it contains. 4) That a list or catalogue of the whole shall be deposited with them. Be so good as to communicate the above to the Royal Society at the first

<sup>59</sup> Chitnis (1970), 86 uses the term 'weapon in the struggle' to denote the way Jameson used the museum instrumentally rather than as a forum for debate. Chitnis clearly concentrated on geological matters of exclusion and not others. It is my contention that because Chitnis only concentrates on geology and not the whole story, the term is therefore misleading in this context. If a 'weapon' can be attributed then it would not be an offensive or counter measure device.

<sup>60</sup> NLS MS ACC 10000/390. Report of the RSE Committee.

<sup>61</sup> For discussion on what I have called, *The Wernerian Resistance*, see Chapter One.

opportunity and acquaint me with these sentiments with regard to this matter. I am dear sir your faithful obedient servant, Joseph Black.<sup>62</sup>

The request was not upheld: why? Waterston argues that Jameson either could not or would not regard Hutton's collection in a Huttonian context:

Jameson's handling of the Huttonian collection succeeded only in destroying it. Jameson was unable to see beyond his own viewpoint – representative, neptunist and catastrophist – to that of its collector – illustrative, plutonist and gradualist.<sup>63</sup>

Waterston has shown that there were clear philosophical differences but perhaps in the light of evidence presented in this chapter, does not elaborate in detail upon the representative/illustrative distinction as such. I have shown that dispute may have been due, in large part, to issues of 'ownership'. Although not denying the theoretical factor, I shall argue that Huttonians were militant in their approach to their specimens through desire to re-possess them.

At the beginning of the nineteenth century, the Huttonian members of the RSE wanted to gain a new Charter for the society that would include legal right to display its property publicly. The inability to display a growing geological collection became a constant source of irritation to the Fellows, and, by 1808, resulted in a rising tide of acrimony. Shapin has noted that: "issues over viewing specimens involved warfare between the Huttonian and Wernerian factions on the grounds of ideology".<sup>64</sup> Professor Andrew Duncan, wrote to John Playfair on the 1 February 1799, offering the RSE a university room for eighteen months in which the Huttonian collection could be kept.<sup>65</sup>

It was soon apparent that this was not conducive to the needs and desires of many members and it was not long before requests were being made for its alteration. The first of these directly followed the ending of Andrew Duncan's lease period and the

---

<sup>62</sup> NLS MS ACC 10000/386. Donation of the Huttonian Collection in a letter from Dr Black December 2 1797 addressed to Professor John Robison, Secretary of the Royal Society of Edinburgh. The letter is contained in an inventory of papers relating to the claim of the Royal Society to be admitted to the college museum.

<sup>63</sup> Waterston (1997), 137.

<sup>64</sup> Shapin (1971), 258.

<sup>65</sup> NLS MS ACC 10000/387/1. Letter of Dr Duncan to Mr Playfair, Secretary of the Royal Society of Edinburgh, February 1 1799, offering a room for keeping the Huttonian collection in. This is the first letter in a series of correspondence between members of the Royal Society of Edinburgh and the University of Edinburgh about the collections belonging to the Royal Society of Edinburgh.



death of John Walker, Professor of Natural History and keeper of the University museum. Members of the RSE showed early signs of disapproval and moved for the Society to seek a new Charter, giving them property rights of their own. John Sinclair was the first to bring this concern to the society at a meeting in January 1801:

Sinclair suggested that it would be advisable that a motion should be made at the approaching general meeting of the society, for the appointment of a committee to consider certain parts of the charter of the Royal Society and to those parts in particular that relate to the society possessing property.<sup>66</sup>

Realising the potential of the Society to house collections of the size of Hutton's, Jameson did not comply with the terms of its Charter. If the RSE could not change the terms, then perhaps it could stall for a long a time to instigate change. It was, however, Jameson that was originally refused by an RSE Commission from inspecting the collection in the first place. Upon making a request to inspect the collection Jameson wrote of his frustration at delays in handing it to him and for not being allowed access to it. Jameson wrote, presumably in 1805:

I must use the liberty of saying that what has occupied them six years and what is still by a late resolution of the society to employ them a year longer might have been accomplished with ease in 6 weeks. But without insisting on the incapability of these gentlemen for the charge with which they were trusted, I must use the liberty of expressing a doubt of the society having a right to appoint such a commission. It was from this view of Dr Black's letter that I so repeat and with such [good] reason of the Professor of Phy [John Robison] to allow to inspect the collection...At the last general meeting of the society it was agreed that I should be excluded from the inspection of this collection for a year – for what reason, because it was said that I was disputatious and would interrupt the learned gentlemen in their arrangement. To such a reason and accusation I have first to answer that surely they were not in earnest after having employed six years in arranging Dr H's small collection and secondly that they are arrogating to themselves the present mod. Of arrangement of the collection – as Dr Black in his letter never mentions a syllable of arranging it according to the Huttonian system. He knows too well that such an attempt would render the collection nearly useless.<sup>67</sup>

Jameson claimed that the view was for the purpose of assessing its present state of repair. The members of the RSE thought Jameson had another agenda, but in making Jameson's frustration appear to be driven on Wernerian grounds, members of the RSE did not wish to relinquish items. The RSE were stalling for proprietary reasons, in order to be able to get time to challenge the laws of the Charter:

---

<sup>66</sup> NLS MS ACC 10000/4.

<sup>67</sup> NLS MS ACC 10000/388.

But the Gentlemen were mistaken – I did not and do not on occasion wish to visit the collection along with them – I was only anxious to satisfy myself as to the present state of the collection and to see it in the state it was left by Dr Hutton and not in the state in which may be placed by the said gentlemen...I will not presume to say what motives have inspired these gentlemen in the present examination but I may venture to say that they will find it difficult to convince the public that they are of the purest kind. It is to me extremely disabling to be under the necessary ap[er]t [sic] to the society on such an occasion but the conduct of the prof. phys and presume the other trustees who have acted in conjunction with him was such that it was imposs. For anyone who had a right feeling of the duties of his office. I trust the society will consider my request and give the necessary order that I may no longer be obstructed in using my duty as professor of Natural history and trust. Of the J H collection.<sup>68</sup>

By appealing to the Crown to allow them to have property of their own, the RSE Huttonians clearly realised the potential of the specimens in setting up a museum of their own. They also knew of their ability to demonstrate Huttonian theory.<sup>69</sup> Realising the potential, a Committee was set up in 1807 to push for a new Charter at the same time (as I have shown in chapter two) that the Wernerians were dominating meetings of the RSE.<sup>70</sup> Owing to the rules of the first Charter remaining in place, the Huttonians could no longer stall and had to hand over the collection to Jameson. Eventually Jameson received the collections, including the Huttonian specimens from the RSE in the appropriate manner and according to Crown law. Jameson was clearly delighted to receive the collections and duly made a press release to let the public know:

Sir, I request you will insert the following piece of news in your paper tomorrow, your Ob. St, Rt Jameson. "it gives me great pleasure to inform the public that the magnificent and extensive collection of minerals bequeathed by that celebrated mineralogist the late Dr Thompson of Naples to the university of Edinburgh has arrived in this country in a state of perfect preservation and is now deposited in the museum of the university. The museum of the university has also lately received another important addition in the interesting collection of the late ingenious Dr Hutton of this place, what is now deposited in the museum of this university." Prof. of N.H.<sup>71</sup>

---

<sup>68</sup> NLS MS ACC 10000/389.

<sup>69</sup> Waterston (1997), 41. Waterston points out that Hutton himself was no stranger to the use of hand specimens for the deduction of earth processes.

<sup>70</sup> For more on this, especially activities regarding the Wernerians in the RSE see chapter two. The Minutes of meetings of the RSE point to this clearly.

<sup>71</sup> NLS MS ACC 10000/39. RSE papers concerning the new charter. Press notice from Prof. Jameson about the Thomson and Hutton collections. N.D. (written in 1805 or later - probably written after 1808 as this is when the Thomson collection was received). It is clear from Jameson's press release that the Thomson collection filled him with more enthusiasm but again care has to be taken not to necessarily attribute theory as chief mode of explanation. This may have been due to the fact that it was a considerably larger collection than Hutton's and because it contained a better selection of displayable material for a Baconian. The number of specimens fit for display of a collection that crosses from one context to another is not great. It is conceivable that few items of the Huttonian collection designed to demonstrate theory, would be deemed fit for display in a Baconian context and only in this context would they render it less useful. Waterston (1997), 44, makes this point by stating that, "it is probable that

RSE activity regarding a change of charter coincided with the greatest period of debate within the Society over geological affairs. The RSE, at first reluctant to hand over the property, set to work on trying to get it back by changing the charter to allow the RSE to display its own collections. Headed chiefly by John Playfair and Lord Meadowbank, their chief aim was to remove its property from the university as to be able to keep and display it in their own surroundings. Playfair stated: “that it is the opinion of the Society that it is expedient to have their Charter free from any restriction respecting the disposal of their property, of whatever kind”.<sup>72</sup>

At the next meeting the Committee with the task to rescind the Charter was formally set up, consisting of Playfair, Lord Meadowbank, Mr Clark, Henry Mackenzie, Dr Wright, Mr Keith, Mr Farquarson and James Bonar. Together they forwarded a petition to the Crown, proving that ownership - the right to display their own property - was above theory, the overriding consideration:

At a meeting of the sub-committee appointed on the 7<sup>th</sup> February by the general committee, Mr Keith was requested to draw up a petition to his majesty and also a new charter in so far as regards the custody of the society's property whether in specimens of natural history or objects relating to antiquities.<sup>73</sup>

At another meeting, this claim upon ownership was officially manifest as the overriding concern of the Charter Committee.

The biggest battle to fight was with the Senatus Academicus of the University. The Senatus was disturbed by the RSE request for complete recall and removal of property. If the charter changed, Jameson would not just lose the Hutton collection but *all* property belonging to the RSE. As I have shown, in 1807, the dilapidated state of the Museum was such that Jameson could not afford to give up his fight to keep the old Charter in place, on proprietary and economic grounds.

---

Jameson attempted to do this by extracting from Hutton's collections such specimens as would enhance the representative collections of the college – a good agate or jasper for the mineral collection or an interesting piece of fossil wood for the fossil collection – but taken out of context these specimens would be ranked *pari passu* with any other mineral or fossil. Where there was no locus within the existing reference collection for specimens speaking in another context – such as a specimen exhibiting successive granitic veins – it would be regarded as worthless and consigned with other similar specimens, to a storage box, if not actually discarded”.

<sup>72</sup> NLS MS ACC 10000/39. RSE papers relating to its desire for a new charter 1807-8. Minutes of General meeting, 26 Jan 1807.

Once again it would appear that this was not so much a theoretically-motivated battle despite Jameson being fully aware of the desire on the part of the RSE for Hutton's collection to demonstrate that theory. This was first and foremost a concern over the ownership and custody of property. Jameson knew that competition would reduce his chances of building the Museum and applying for funds to the Crown for its expansion. He could only do this, as I have shown, by relying on small donations. The old Charter as it stood, was Jameson's lifeline of survival.

The RSE members, having lost the right to remove its property, sought to gain a compromise by being assigned inspection rights. Jameson's objection can once again be attributed to proprietary concerns. If the Royal Society could not remove their own materials, they would push for the right to use a separate room in the university with a separate keeper. Jameson was outraged at the conduct of the RSE members to get a new Charter and wrote to the advocate, Mr Ross, to express his disapproval at the proposed action, and sought legal advice to prevent it from happening:

When I accepted the Regius Professorship of natural history in the university of Edinburgh I considered as secured to me by the charter of the Royal society of Edinburgh the important privileges of superintending and demonstrating in my class the collection of natural history that had been or might in future be acquired by the said society - further that I possessed a patrimonial right in the charter consequently that no new charter or alterations in the old one, as far as they affected me, would be obtained without my concurrence. The Royal Society lately applied to the crown for a new charter...Mr J therefore requests Mr Ross could favour him with answers to the following queries: 1.Whether or not Mr Jameson as Regius. Prof. of Nat Hist possesses such a right in the old charter of the royal society of Edinburgh as will enable him legally to oppose the petition for the new charter. 2.Whether or not the patrons of the university have a similar right.<sup>74</sup>

With the backing of the *Senatus Academicus*, Jameson sought to keep the old charter in place otherwise he would lose property in his possession that belonged to the RSE. Probably fearing the removal of property, Jameson sought a compromise with the new RSE sub-committee in place by April 1808. In a set of regulations drawn up by Jameson which eventually received the backing of the *Senatus* who had initially opposed it for not wishing to compromise at all, Jameson suggested to the RSE that his proposals should form the basis of any new charter, thus eventually receiving approval:

---

<sup>73</sup> NLS MS ACC 10000/39. Meeting of 17 February 1807.

<sup>74</sup> NLS MS ACC 10000/40. Jameson to Mr Ross, advocate, 45 George Sq, April 9 1808. Regarding the new charter for the Royal Society of Edinburgh.

They [the senatus] agree to express their concurrence in the application of the Royal Society for a new charter provided it shall contain the following regulations which were proposed in the senatus academicus by the Professor of Natural History viz....first, that a room shall be provided within the college and appropriated exclusively to whatever collection of objects of natural history may be presented to the Royal Society; secondly, that the exclusive right of arranging these objects shall be vested in the royal society and that the arrangement they may adopt shall not be changed in any case without their consent; third, that the Royal Society shall appoint a keeper or committee for superintending this collection through whom the members may at all times have access to it; fourth, that the professor of natural history shall also have at all times access to the collection but that it shall not be liberty (without the consent of the society previously obtained) to exhibit in his class any objects that may be deposited in it except such as can be exhibited under glass and can thus be secured from enquiry by the students; fifth, that the collection of minerals sometime ago presented to the Royal Society by the late Dr Hutton and which is at present placed in the room to be appointed to the collections that may hereafter be presented to the royal society and it shall continue in all time coming as part of that collection and subject to the regulations proposed in the proceeding articles; sixth, that in the room provided for and appropriated to the collection cannot accommodate the royal society for its usual meetings, another suitable apartment shall be provided within the college for that purpose.<sup>75</sup>

The overriding factor was to keep the items of property in the possession of the university. Instances of compromise were such that anything but the removal of the property itself would be acceptable - even the provision of space on college premises.

These terms were accepted by the RSE after its charter challenge had failed. Luckily for Jameson the most important issue regarding the question of removal and recall was resolved in his favour. The Lord Advocate wrote in 1808, concerning the charter of the Royal Society:

The senatus academicus of the University of Edinburgh being obtained [now] to and that the collection therefore deposited in the Museum of the said university in virtue of our former Royal Charter shall not be removed hence by the royal society, but on the contrary shall remain in the said Museum and be subservient to the uses more of and to the course of lectures given by the professor of natural history in the University of Edinburgh.<sup>76</sup>

The Lord Advocate found in favour of Jameson and held that property, most specifically the Royal Society's geological collections, was to remain the exclusive right of the University. Despite another appeal by Lord Meadowbank, the Lord Advocate held to that opinion.

It was not long, however, until the argument appeared again. Given that the Royal Society had failed in its attempt to change the charter and remove property from the

---

<sup>75</sup> NLS MS ACC 10000/386/6. Regulations proposed by the college respecting the property of the Royal Society of Edinburgh April 21 1808.

<sup>76</sup> NLS MS ACC 10000/390. Notes by the Lord Advocate on the Charter of the Royal Society of Edinburgh, July 1808.

Museum, the Society continued to regard the collections as its own property. By 1811, the Royal Society set up another Committee, this time under Sir George Mackenzie, to push for inspection rights. The Committee met on 23 December 1811 and complained that Jameson would not furnish them with satisfactory answers to its queries.

Jameson subjected the Committee to a frustrating series of letters to the RSE that they duly read out. It stated that Jameson initially refused permission until a full list of items belonging to the Society was given to him. The RSE, not satisfied, sent replies to Jameson:

The Committee of the Royal Society have received Prof. Jameson's letter and which they cannot consider as an answer to their former communication...in case the Prof. May have mislaid it, the committee have to beg an answer to this question; will or will not professor Jameson admit them into the college Museum for the purpose of reaching and examining the property of the society? The professor will find the donations of the Royal Society recorded in the transactions.<sup>77</sup>

Jameson eventually allowed access to the inspectorate, and Sir George Mackenzie produced an annotated catalogue.<sup>78</sup> Difficulties in obtaining access to the Hutton collection continued, however - reported by the Committee until 1827 - with news of Jameson not entirely refusing but being evasive and difficult and not giving clear replies.<sup>79</sup>

Other reasons have been imputed to explain Jameson's actions. One is the argument of personal reputation. I have shown that in a wider context this was of concern, but can it be attributed in relation to the context of Jameson's conduct with regard to Hutton's rocks?

Jameson argued he had inherited a museum in a state of near ruin, depleted of material and wholly inadequate for viewing by professionals of his own standing and social status. He felt not only that there was material unfit to view, but also not enough of it: the "Museum was so inconsiderable that the whole of the articles were contained in a few cases".<sup>80</sup> Although this may have been factually correct, one cannot rely on the

---

<sup>77</sup> NLS MS ACC 10000/386/9. First Report of the Committee appointed to inspect the property of the Royal Society, 23 December 1811.

<sup>78</sup> NLS MS ACC 10000/386. See also Waterston (1997), 45.

<sup>79</sup> NLS MS ACC 10000/387 and NLS MS ACC 10000/390. Correspondence of Sir George Mackenzie with the University about the collections, 1821 and the 1821 Report of the RSE Committee.

<sup>80</sup> *Evidence* 1.

personal claims of Jameson as tangible evidence of truth telling, nor that it was the 'real' reason for his denial of Huttonians.

Yet the proprietary argument lends weight to my claim. If members of the RSE were intent on repossessing property and not just viewing it, then the RSE's case for repossession of property would be strengthened if it could prove that specimens were kept in a poor state of repair. Jameson's poor resources and his low funding did not help his cause, and, further, his reputation as a keeper would be undermined if the RSE saw his museum in a poor state of repair.

Jameson may not have displayed Hutton's collection on intellectual grounds. Seen through Baconian eyes, there would not have been many rock samples to provide interest. As Waterston points out, Jameson may have viewed the Huttonian collection as a series of rocks rather than something that demonstrated evidence of a particular theoretical position. Hutton's collection was formed in a totally different intellectual context of deductive science with the purpose of proving a theory.<sup>81</sup>

The way this manifested itself physically was to demonstrate different aspects of the rocks, but more importantly, it would not be seen, to a Baconian, as *necessarily* showing or demonstrating anything. A granite vein would have much greater significance to a Huttonian by providing evidence in support of subterranean heat. To a Baconian, and for display purposes, it might not need to be demonstrative of anything in order to be displayed (or not). Waterston suggests that:

In Walker's museum the viewer could see a range of the natural products of Scotland and could judge for himself the application that might be made of them for the improvement of the nation. In Hutton's museum the viewer saw evidence illustrative of that philosopher's theory, without travelling many miles to examine the field relationships, and could judge for himself the validity or otherwise of its various propositions.<sup>82</sup>

It is not known that Jameson made it clear in the findings of the Senatus Academicus that he was concerned about having a rival collection in the city. What is unclear is whether he meant theoretical rivalry or merely competition for his museum:

---

<sup>81</sup> For a recent discussion of Hutton's methodology see Leveson (1996).

<sup>82</sup> Waterston (1997), 44.

Mr Jameson begs leave to state for himself, that he foresees all the inconveniences likely to result from the establishment of rival collection which the Senatus Academicus so emphatically pointed out when they advert to the views of the society of Antiquaries “It appears to the Senatus Academicus that the establishment of another public museum would not only intercept the communication of many specimens and objects which would otherwise have been deposited in the museum of the university but may induce and enable the society of Antiquaries to institute a lectureship of Natural History in opposition to the Professorship in the University” End.<sup>83</sup>

It seems that Jameson’s overriding concern was the threat to his position as keeper and professor rather than evidence that contravened Wernerian theory. Wernerianism *per se*, rather than being a theoretical tool, may have been used as a political tool to curb what he considered the ‘politically subversive’ activity of a Huttonian committee ultimately intent on wanting recall of its property, and, thus undermining the collections of the museum. Theoretical reasons were, of course, contributory, but they were secondary. Jameson knew that the Huttonian collection was to be used to refute Wernerian theory. The proprietary argument here advanced is further strengthened by looking at another controversy concerning rock specimens that purported to favour Huttonian theory: the Icelandic rock collection of Sir George Mackenzie.

#### 4.3.2 Further Conflict: Jameson and George Mackenzie’s Collection

I shall show here, that an examination of Jameson’s reaction to Sir George Mackenzie’s collection in the museum bears a resemblance to the case of Hutton’s rocks, and does not require the use of Wernerian theory *per se* as explanation of his conduct.

Mackenzie claimed to have sent Jameson 200 or 300 specimens for public display. They were sent to Jameson in the summer of 1810, shortly after Mackenzie had arrived back from Iceland.<sup>84</sup> At that time, Mackenzie spoke of having difficulty in gaining access to his pieces because he wanted to put labels on them. However, Mackenzie’s testimony shows that he wanted the specimens displayed according to a Huttonian theoretical schema:

I repeatedly met Professor Jameson in the course of my visiting the class in the college, and spoke to him very often about them and at last said that, as I was going to the country, I wished to put

<sup>83</sup> NLS MS ACC 10000/[?]....Part of the minutes of the Senatus Academicus of the University [n.d.] [Prob.1808] sent to the RSE.

<sup>84</sup> For more on Mackenzie’s voyage in Iceland see Mackenzie (1811), and Wawn (1987), and Peacock, (1925).



labels on these specimens; and to this day I have never seen the specimens since I packed them up.<sup>85</sup>

Mackenzie was never actually refused permission to the museum itself. When he enquired, Mackenzie could not deny that had been the case, but seemed to imply that he was always discouraged, owing probably to the fact that Mackenzie wished to arrange specimens according to his own schema: “We understand he never refused to allow you? – Never positively, but always put me off from time to time”.<sup>86</sup> What Mackenzie was refused was permission to lay out the specimens in a way that would illustrate Huttonian theory, arguing to the Commissioners that it was the reason why Jameson refused him:

Supposing that you or any scientific person wished to illustrate any particular view or theories, was the collection referred to such as to enable you to do so? – “Yes. It certainly did exhibit facts directly opposed to theoretical views that professor Jameson then held: and it did illustrate the Huttonian theory.”<sup>87</sup>

Knowing Mackenzie’s plan, Jameson did his best to prevent it. This was because he considered Mackenzie’s samples to be amongst items of his own, to display at his (Jameson’s) own discretion. Further, his reply to the Commissioners bear all the hallmarks of a non-theoretical approach to their display:

Do you remember the minerals that were presented by Sir George Mackenzie when he returned from Iceland? – “I remember of a collection of pieces of rock from Iceland having been sent”...I suppose they were put in by Sir George for the benefit of the public? – “Sir George’s specimens, as I have already said, are pieces of rock. For these, and all similar articles, there is no accommodation at present”.<sup>88</sup>

Jameson continued to be pushed:

Could not they be arranged so as to show what the rock is? The whole of that collection is we understand, quite out of sight to the public, – “No; there is want of room. To display our Rock collection to the public, would require a room at least 100 feet long, with glass cases”.<sup>89</sup>

---

<sup>85</sup> *Evidence 1*, 618.

<sup>86</sup> *Evidence 1*, 618.

<sup>87</sup> *Evidence 1*, 618. Two things suggest themselves concerning Mackenzie’s reply. He first referred to Huttonian theory as being *fact* in opposition to the mere *views* of Jameson. Secondly he made the comment “views that professor Jameson *then held*”. Does this mean that by 1827 Jameson no longer did? For consideration of this question see chapter eight.

<sup>88</sup> *Evidence 1*, 634.

<sup>89</sup> *Evidence 1*, 634.

Jameson did not attach any significant value to Mackenzie's collection although he was aware of its potential as products to illustrate Huttonian theory.<sup>90</sup> To Jameson, the Mackenzie collection demonstrates that significance in theoretical terms was not sufficient criteria for its exhibition. It is difficult to attribute their 'non-value' as exhibits in the Baconian sense as an excuse for Jameson not to show the specimens. When coupled, however, with the argument of available space, a Baconian using a Wernerian colour-graded scheme could not justify showing 300 pieces of 'black rock'.<sup>91</sup> Glass cases would be used to display minerals that were related to their 'mineralogical' value, and based on external characteristics, not their 'mode of formation' in a theoretical sense.<sup>92</sup>

So far I have identified why proprietary concerns for reasons of reputation and economics played a part in understanding the nature of Jameson's activities with regard to museum access. I have also shown that even with collections that purported to demonstrate Huttonian theory, it was not theoretical concerns *per se* that were the reason behind many of Jameson's decisions. I have also demonstrated that his philosophy in regard to display shows that he did not consider specimens appropriate for promoting theoretical viewpoints. The Mackenzie collection was never displayed publicly but this is not to say that Huttonian collections did not exist. In opposition to Jameson's chosen criteria of display, I shall examine collections that did purport to add credence to the Huttonian theoretical position. A study of these Huttonians with private collections further highlights differences in methods between them and Jameson.

#### 4.4 Huttonian Collectors: Thomas Allan and Ninian Imrie

In contrast to Jameson, who was successful in preventing the setting-up of rival public collections, two private mineralogical and geological collections were housed by Thomas

---

<sup>90</sup> Jameson would have known this through his attendance at RSE meetings in 1811 where Mackenzie's Icelandic paper was read. Henry Holland's testimony shows that Mackenzie was very proud and confident of the Iceland publication being testament to the truth of Hutton's theory. For full discussion see chapter five.

<sup>91</sup> The Mackenzie samples are now kept at the Hunterian Museum in Glasgow, ironically, in a vault storage facility and not for public view! Permission was granted to take photographs in 1996 and a sample can be seen in chapter five.

<sup>92</sup> For primary and secondary sources on Jameson's collection philosophy see Jameson (1817), and Sweet (1970).

Allan, (1777-1833), banker and private mineralogist,<sup>93</sup> and Col. Ninian Imrie (d.1820).<sup>94</sup> Little is known about either their activities or their respective contributions to geological debate in early nineteenth-century Edinburgh.<sup>95</sup>

Thomas Allan was a highly influential and well-respected independent mineralogist and follower of Hutton. It is likely his collection was very large and may even have been the largest private mineralogical collection in Scotland at this time. Sir George Mackenzie regularly visited it and was much inspired, as his colleague (later to be London physician) Henry Holland, explained in a letter to his father:

I spent two or three hours with Sir George Mackenzie and Mr Allan in the mineralogical cabinet of the latter. This collection is one of the most splendid kind, made entirely through his own individual exertions.<sup>96</sup>

When Charles Giesecke returned to Leith from Greenland, he visited Allan and spoke highly of the collection that Allan had rescued by buying it when all other opinions on its merits from Edinburgh mineralogists were to the contrary.<sup>97</sup> Allan wrote that the collections of his specimens Allan had rescued and displayed inspired Giesecke:

---

<sup>93</sup> Biographical information for Thomas Allan is rather sketchy apart from the *DNB*; the best biographical source list was compiled by Shapin (1971). Born in Edinburgh, Allan attended Edinburgh High School and worked in his father's bank. Thomas Allan was elected Fellow of the RSE in 1805. He was keeper of the RSE museum and library from 1812-1820 and treasurer of the RSE between 1821-33 owing to his skills as a banker. In 1809 Allan published an alphabetical list of the names of minerals, in 1813 on a sketch on Humphry Davy's lectures on Geology and on mineralogical nomenclature with synoptic tables. He also published in the *TRSE* Vols. 6, 7-9. Allan was appointed to the 1811 RSE Committee set up to examine the property of the RSE in Jameson's Museum. He was a Fellow of the Royal Society.

<sup>94</sup> Biographical information is very sketchy. Shapin, (1971), 'Collective Biography' contains a little information. Imrie was elected Fellow of the RSE in 1797. He was a Councillor from 1816-1819 and a military man. He was an amateur collector and writer on how to collect. He published in the *Memoirs of the Wernerian Society* Vol.1 & 2 and *T.R.S.E.*, 4 & 6. He was a member of the 1811 Sub-Committee on the geological property of the RSE and of the Wernerian Society.

<sup>95</sup> There are no published papers on Ninian Imrie. One paper has been published by Farrar and Farrar, (1967), on Thomas Allan, giving only a sketch of his life.

<sup>96</sup> NLS MS ACC 7515. Letter of Henry Holland to his father, Edinburgh, March 4 1810.

<sup>97</sup> Extract of Thomas Allan's diary and reprinted in Farrar and Farrar (1967), 117. Allan had faith in the mineralogical merits of this collection. In his diary he wrote about its rescue saying: "I heard that parcel of minerals which had been captured on board a vessel from Iceland would shortly be offered for sale in Leith. After a considerable delay I at last heard that they were to be seen under the care of a mercantile house but was told by several people who had seen them that they were a mere pack of rubbish not worthy the attention of any mineralogist – such was the report I received from Dr Hope, Prof. Jameson & Dr Murray – the only three men in Edinburgh who were at all likely to be able to appreciate their merits – Col. Imrie had also seen them and his report being no better, I was in no hurry to examine them".

I requested him to breakfast with me next morning and to spend the rest of the day in my cabinet. He was with me by times, he went over to my drawers with great diligence and great delight and towards dinner-time he made the following remark which I shall never forget. My life, said he, has been devoted to science, my collections were for the purpose of science, I thought it a great misfortune when I lost my collection of minerals, but now I see the use it has been put to I regret it no longer.<sup>98</sup>

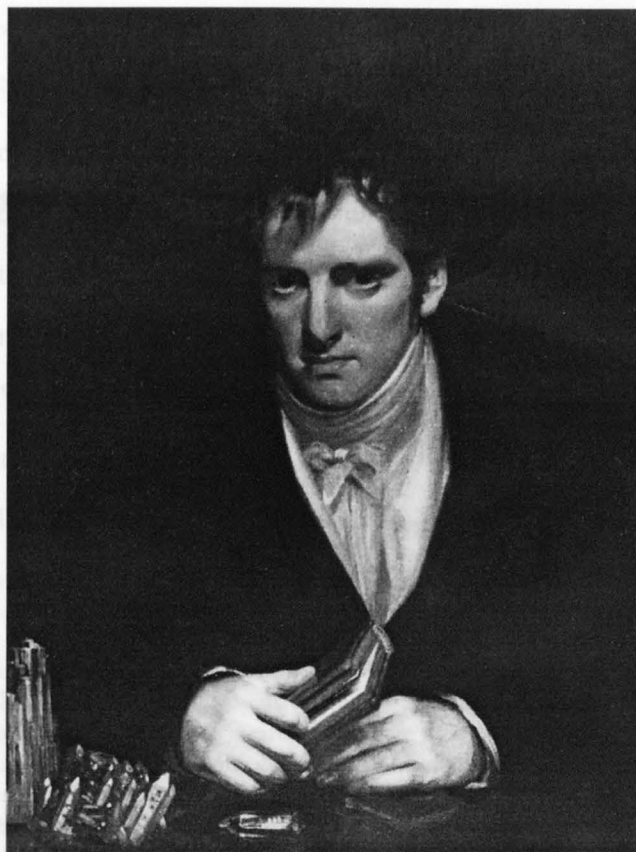


Figure 3. Portrait of Thomas Allan [Anon]. Printed by permission of the National Museums of Scotland.

Unlike Jameson there was no doubt that Allan expressed a desire to exploit the theoretical value of specimens by requesting that they should accompany all geological papers:

I consider it of very great importance that every geological paper should be accompanied with specimens, in order that if the former be found deserving of publication in your transactions, those who may pursue [sic.] the description may know, that the specimens referred to, are to be seen in the repositories of this establishment.<sup>99</sup>

<sup>98</sup> Farrar and Farrar (1967), 119. Extract from the personal diary of Thomas Allan that is privately owned by Miss Ruth Morrison Bell, (Trans. Jessie Sweet, Royal Museum of Scotland (1971).

<sup>99</sup> Allan (1812), 411. See also Allan (1815), 133.

Allan believed collections should be used for verificatory purposes in contrast to Jameson's descriptive outlook and that specimens be used as a form of 'evidence' specifically to back up what would have been clear theoretical claims made in geological papers of the *TRSE*. This was something that Jameson never did, instead preferring to use field observations. This would have been known as geology continued to remain an active interest of Fellows of the RSE. This was reflected in the number of donations received. Waterston has pointed out that of the twenty-six donations of collections that the Society received between 1811 and 1826, nineteen were geological.<sup>100</sup>

Having said this, it must be noted, however, that Allan, gave greatest credence to the place of Huttonian theory in geology but did not endorse it without scepticism. He gave praise to the Wernerian Natural History Society for its largely Baconian stance in its accomplishments in the classification and identification of minerals, in his words, neglected by his fellow Huttonians.<sup>101</sup> In disagreeing with Playfair and Hall, Allan noted the following in his "On the Rocks in the vicinity of Edinburgh":

This was the ground [Edinburgh] which, in all probability first suggested the theory to Hutton; and it was perhaps here that this comprehensive mind originally laid the foundation, of the structure which he afterwards so successfully reared. But that theory, in itself so beautiful, and in many points so perfect, i am very far from embracing entirely. I am very far indeed, from following through his formation and consolidation of strata, or the transportation and arrangement of the materials, of which they are composed. There are other circumstances also, which, though totally irreconcilable with any other hypothesis, are yet imperfectly explained by his.<sup>102</sup>

By giving their collections for display, Allan and Imrie knew that the specimens would be used as evidence in support of Huttonian theory. To the RSE, these specimens would have provided the next best Huttonian account owing to the fact that Jameson had, under charter, won the right to keep the Hutton and Mackenzie collections in his possession.

Allan donated specimens in 1811 that corresponded to his papers, 'On the Rocks in the Vicinity of Edinburgh' *TRSE* (1812) and his (1815a) paper also in *TRSE* entitled, 'Remarks on the Transition rocks of Werner', both papers supporting Huttonian

---

<sup>100</sup> Waterston (1997), 48.

<sup>101</sup> In Gillispie (1959), 80.

<sup>102</sup> Allan (1812), 408. In Gillispie (1959), 80.

theory.<sup>103</sup> These collections have been catalogued with Allan donating seven separate collections to the Museum.<sup>104</sup> Ninian Imrie also donated specimens to illustrate his 1812, publication in the *TRSE* on the 'Geology of the Grampians'. He collected and donated a set of specimens labelled 'Collection of Specimens illustrating the section of the Grampians with descriptive catalogue'.<sup>105</sup> Sir James Hall and John Playfair also donated specimens that were used to illustrate aspects in favour of Hutton's theory in their publications.<sup>106</sup>

Despite its instrumental uses, the true nature and full extent of the collection of Thomas Allan and its value was only fully understood upon it being revealed to the public after his death in 1833 when it was sold off. The auction notice in the *West Briton Magazine* of 26 December 1834 noted that an initial starting price of £2000 would be required:

It consists of 6800 specimens contained in a hundred and fifty four drawers, encased in three handsome cabinets. The specimens rarely exceed five inches in diameter and are as remarkable for their characteristic features as for the singular beauty and excellency of their arrangement. The value of the collection is enhanced by an ample descriptive catalogue which contains about 1500 correct diagrams of the most interesting crystallised forms. This valuable work was prepared with great scientific skill and study by the late proprietor and is considered by judges to be perfectly unique.<sup>107</sup>

Allan's catalogue was a very comprehensive piece of mineralogy that encompassed crystallographic sketches. As arguably, the best chance that the RSE museum had to

---

<sup>103</sup> The donations of Thomas Allan to the Society Museum on George St and which correspond to his publications are listed by Charles Waterston (1997), App 1. 157. For the (1812) publication, Allan used a collection of 81 specimens illustrating the mineralogy of the country around Edinburgh. Two specimens were donated by Sir George Mackenzie. A full list can be found in NLS MS ACC 10000/396. For Allan's (1815), paper, Cornish specimens were used. See Allan (1815a), 133-8 Appendix listing.

<sup>104</sup> The Allan and Imrie collections housed in the RSE Museum are listed in *TRSE* Vol.6 as donations founding the Society's Museum following the new charter that was sealed in 1811. A full list however, can be found in Waterston (1997), App 1, 145-192. Allan's donations are listed on pages 157, 158, 161, 162, 164, 165, 179; Imrie's donations are listed, 157.

<sup>105</sup> NLS MS ACC 10000/396.

<sup>106</sup> Waterston (1997), 48. The original list is in NLS MS ACC 10000/396. The model corresponds to Hall, (1815a), in illustrating his account of the granite contact phenomena of Windy Shoulder near Loch Ken [sic]. Playfair used specimens from Glen Tilt that he collected whilst accompanied by Lord Webb Seymour and were used in Seymour (1815). The Playfair/Webb Seymour collection was given over the Hunterian Museum, Glasgow University in 1909 and 1910 (Waterston, 1997, 164).

<sup>107</sup> *West Briton Magazine* 26 December, 1834 Column entitled 'To mineralogists: Sale of the Lauriston collection of minerals'. The collection was sold by Allan's son, Robert, to the Greg family of Manchester who added to it. It was then known as the Allan/Greg collection. In 1860 it was acquired under this new

house collections for verificatory purposes, Allan and Imrie furnished the Society with a way of illustrating Huttonian theory.

Through the brief presentation of what little is known about them, two major contrasts to Jameson emerge. Firstly, Allan and Imrie favoured the use of specimens for illustrating theoretical perspectives as can be seen from their use of them in *TRSE* publications; second, their collections, as privately owned, could be used for ‘purely’ scientific purposes and did not carry any political, professional or institutional importance. Specimens to Jameson had economic and utilitarian consequences.

## 4.5 Conclusion

In this chapter, I have shown that issues of property ownership, personal reputation and credibility and economic competition were more important factors than geological theory for explaining Jameson’s proprietary action over collections. Jameson’s need to hold on to whatever he could in order to enhance the museum reputation and to receive Crown funding proved greater and more important than theoretical rivalry. This has been proved on the grounds that Jameson did not display items to illustrate or support theory. A factual Baconian display philosophy remained firmly in place. Huttonians with private collections did use specimens as refutatory evidence. In arguing this viewpoint, however, I am not denying that theoretical considerations were a factor in Jameson’s decision to refuse access: clearly Jameson knew how the RSE would display their items. I claim only that it is not the most important factor in any explanation of his actions.

Like the scientific society and the classroom, Jameson’s activities in the museum show that in another site for natural knowledge enquiry, Jameson’s activities, although Wernerian, should not be considered as solely driven for theoretical reasons. The implications so far are that Jameson was a Baconian and that he adhered to descriptive and external qualities in scientific investigation. The implications for understanding the contribution of the museum as a tool for furthering debate over theory must be revised in the light of this study. To add further credence to the argument of the precise nature

---

name by the British Museum where it remains along with the catalogues, in the department of mineralogy

---

of Jameson's Wernerianism and its overall impact on fuelling debate in Edinburgh over theory, I shall go on to examine Jameson's activities in the field, a site where observations did contribute to his publications.

---

of the Natural History Museum, South Kensington.



## OBSERVATION: THE USE OF THE FIELD

### 5.1 Introduction

Oldroyd argues that in the nineteenth century the most important domain of activity for geology was the field.<sup>1</sup> Despite this, there has been little attention paid to fieldwork in Scotland during the later Enlightenment period.<sup>2</sup> At this time fieldwork practices underwent considerable change from an amateur pursuit in the guise of the ‘Grand Tour’ to the highly specialised analytical and mapping activity undertaken by the ‘gentlemanly specialist’ of the 1830s.<sup>3</sup> What follows is a study of these changes in the Scottish context, by looking at the activities of Jameson, James Hall and Mackenzie. It also sheds light on differences in focus to the use and interpretation of nature and purposes for doing so, Huttonians being far more highly ‘theory’ driven.

Change in early nineteenth-century Scottish fieldwork practice was instituted in newly-formed societies and institutions that placed demands for ever more specialised forms of natural knowledge. Despite this knowledge often being collated and gathered in remote locations as a solitary exercise, or, at the most in small groups, the results were used actively to promote geology as a ‘civic’ enterprise through debate and the production of the printed publication.

---

<sup>1</sup> Oldroyd (1990), 2.

<sup>2</sup> Field investigations before the nineteenth century have been noted by Porter (1977), and Laudan (1987).

<sup>3</sup> Fieldwork practices in the Victorian period have been extensively studied. The most comprehensive compositions to date are by Oldroyd (1990), Rudwick (1985), and Secord (1986). On the theme of the study of the field sciences see Kucklick and Kohler, (1996).

Laudan argues that fieldwork was assigned the status of a ‘credible’ means to knowledge gathering much earlier and that, by the late eighteenth century, rocks and their ‘formations’ identified in the field had taken over from the laboratory as sources of data for historical geology.<sup>4</sup> By 1800 it was assumed that strata could be ‘ordered’ through the indicators of fossils and topographic investigation.<sup>5</sup> The ways in which these *practices* developed are much less known, especially in late Enlightenment Scotland. In what follows, I suggest that fieldwork was highly complex, incorporating a multitude of methods and motives. Here I show how much of Jameson’s fieldwork contrasted with the investigation of Huttonians both before and after the death of Hutton.

The picture of changing fieldwork practice is one of considerable complexity. Although there was a theoretical content to Jameson’s work in the field, I begin by showing that much of his work was undertaken as observation in the form of ‘Baconian’ fact gathering methods. In contrast, I show that whether as part of an amateur ‘Grand Tour’ or as a specialised undertaking, a commitment to observation for Huttonian theory was prominent. This sheds further light on the contrasting use of the situated nature of natural knowledge between Huttonians and Wernerians.

The decline of Baconian fact-gathering methods in the field is clearly evident over a very short period from the late 1780s to 1810. In 1800 Robert Jameson in *Mineralogy of the Scottish Isles* was still advocating the Baconian virtues of non-theory-driven field methods, arguing in favour of fieldwork serving a purely utilitarian purpose:

Another resolution I had formed to myself, and which partly indeed led me to choose the form of a journal, was to shun the fascinating evil of speculation and hypothesis, which mars all faithful observation. It would ill suit my talents to venture upon deep speculation, were I inclined; and perhaps the state of mineralogical knowledge forbids it. It is a fitter task for me to record faithfully what I have myself examined, and to give a fair report of the materials which were collected than to expose myself, by the form or arrangement of the work to the danger of having the facts twisted and perverted by hypothesis, the rage for which is as remarkable in this as in the other sciences. While in mineralogical pursuits, there is much to interest a philosophical mind, the object of true value is its application to economic purposes. I fear that the theories of the formation of the earth, interesting as they are, often mislead the mind, and pervert the understanding; and those who yield to them, become so involved in delusive speculations, so blind to fact and experience that, like archimedes, they find but one thing wanting to raise worlds. Of the utility of this science

---

<sup>4</sup> Laudan (1987), 101.

<sup>5</sup> Porter (1977), 176.

---

there can be no question more particularly when it is freed from the vague suppositions of the theorist.<sup>6</sup>

By 1810 George Mackenzie was writing in a very different guise and had all but abandoned Baconian inductivism for theory related verificatory purposes. Fieldwork for Mackenzie was more than mere observation of nature: it was a goal-directed and theory-driven systematic approach. Writing in *Travels in Iceland* (1811), he noted:

In the present state of geology, nothing can be of greater importance than to ascertain with accuracy, what are results of heat acting on bodies under strong compression; since, by means of that knowledge, we are enabled to compare the ordinary deductions from Dr Hutton's principles, with the phenomena of nature, and bring to the test of actual observation the merits of a system which promises fair to put us in a possession of a most simple and beautiful view of the mineral kingdom.<sup>7</sup>

Geological controversy in the RSE had reduced economic or utilitarian fieldwork to a status of less importance, fuelling the fire for the gathering of field data as 'evidence'. The genesis of assigning 'public' credibility to field knowledge was also the product of a wider social attitude regarding the status of travel, a respected undertaking in eighteenth-century Scotland for a 'man' of learning.

### 5.1.1 Travel in Scottish Enlightenment Culture

When Charles Lyell recommended "travel-travel-travel" as his three pieces of advice to the geologist, fieldwork had become widely recognised by the early nineteenth century as an important qualification for being taken seriously in that science.<sup>8</sup>

Travel in geology has, however, earlier roots. Secord notes that the development of the Romantic taste for wild nature, and the creation of a network of inns, itineraries, roads and guides, travel had become a fashionable pursuit for the leisured classes.<sup>9</sup> Earlier still, it became increasingly important for rational enlightenment.<sup>10</sup>

In the eighteenth century, it was considered highly beneficial to a young gentleman's education if the Grand Tour consisted not only of meetings but also lengthy

---

<sup>6</sup> Jameson (1800), 11.

<sup>7</sup> Mackenzie (1811), 362.

<sup>8</sup> Lyell, (1830-1833), also in Secord (1986), 25.

<sup>9</sup> Secord (1986), 25

observation of landscape.<sup>11</sup> Nature and the sublime were increasingly becoming subjects for aesthetic and intellectual appreciation and many eminent gentlemen ventured forth not just to Europe's great cities but to many remote and often inhospitable locations including volcanic terrain, mountains and the polar regions.<sup>12</sup>

How did this come about? According to Porter, the rational use of fieldwork through travel had its origins as early as the 1690s. Porter suggests that whilst most seventeenth-century earth theorists were not outwardly seeking to be fieldworkers *per se*, there was an emerging interaction between 'the field' and 'theory'. Empirical research in these early times therefore allowed for later generalisations of theoretical perspectives to be expounded by earth theorists such as John Ray, William Woodward and Robert Hooke.<sup>13</sup>

Porter has shown that travel became more popular with earth theorists because of the increasing conceptual and practical focus that was placed upon 'strata' as a form of investigation.<sup>14</sup> To make sense of strata, vast tracks of land had to be covered to 'connect' successions of outcrops, making observation of landscape a three-dimensional (if inferential) schema. This notion of 'connectivity' gave rise to a new confidence in tracing and covering vast tracks of landscape, resulting in fieldwork not just at 'single site' locations but the beginning of the coverage of great distances. Laudan has also particularly emphasised this shift from the mineralogical 'single site' operation to the extensive examination of vast areas by the historical geologist.<sup>15</sup>

Travel was a very important component of fieldwork. But what of those who practised it? It is only by demonstrating how the earlier relationship between ideas and practice developed through actual historical examples that a fuller understanding of the way fieldwork evolved can be fully understood. In doing so, I shall advance evidence to support the claim that during the nineteenth century in Scotland, fieldwork was being

---

<sup>10</sup> For work on the Grand Tour in the eighteenth century, see Black (1992). For work on artistic impressions of landscape whilst on the 'Grand Tour', see Rudwick (1992).

<sup>11</sup> This can be seen in Sir James Hall's diaries in the 1780s.

<sup>12</sup> Black (1992).

<sup>13</sup> Porter (1977), 79.

<sup>14</sup> Porter (1977), 119-121.

<sup>15</sup> Laudan (1987), 101.

undertaken both as descriptive *and* as a verificatory undertaking. Simultaneously. I shall begin by examining Jameson's activity and contrast this with Sir James Hall and George Mackenzie.

## 5.2 Robert Jameson and the Field

What has been discussed to date, concerning Jameson, has concentrated on his teaching and museum activities. This should not be allowed to shadow his rich and diverse career in the field. Jameson's field endeavours have not been the topic of systematic historical examination. His work, in this respect, not only demonstrates a changing relationship between theoretical ideas and older amateur field endeavours: it also represents a shift from the amateur pursuit of the gentlemanly 'Grand Tour' to fieldwork as a 'geological' activity.

Jameson made his tours specifically mineralogical and geological. Although a devotee of Werner, he did not readily promote fieldwork as a tool for providing theoretical proofs. Jameson is often seen, rather, as a teacher, who devoted his time to promoting Werner's theory in the interior spaces of the class or museum. Dean has presented Jameson thus, noting also that some of Werner's students went on to become geological explorers of unknown and exotic regions and that others, like Jameson, preferred the classroom with fieldwork limited to a search for examples that would confirm Wernerian theory.<sup>16</sup> I want to suggest here that an over-emphasis on labelling Jameson as 'teacher' and 'keeper' has obscured understanding of Jameson's geological work outside of classroom, and museum. Another factor tending to diminish the importance of Jameson's fieldwork is the fact that he chose to study sites within Scotland. This made Jameson appear less travelled than many of his contemporaries, although the number of his excursions far outweighed others.

Yet Jameson did not confine himself to Scotland as his 'laboratory' of observation. He was offered opportunities to travel abroad.<sup>17</sup> Jameson's choice of localities owed much to his personal ambition to map Scotland fully for the publication

---

<sup>16</sup> Dean (1992), 97-101.

of a mineralogy of that country, and because his chance to become Professor of Natural History was being realised through his relationship with Dr John Walker. In 1801 he was selected to be the first mineralogist on an expedition due to set sail that year. In a letter to Jameson's father, Charles Hatchett spoke very highly of him<sup>18</sup>:

You sufficiently know how great a regard I have for your son Mr Robert Jameson but without being partial to him on this account I may say with truth that I believe few in this country are so well versed in mineralogy, or are so well calculated to promote by instruction the cultivation of that valuable and much too neglected science...His majesty has been pleased to direct that two ships should be fitted out in order to examine the whole coast of New-Holland. An eminent botanist has been appointed and the celebrated Mr Bower has been nominated to go as draughtsman another appointment remains which is intended for some gentleman well skilled in mineralogy and an application was made to me that would recommend such as to my personal knowledge was properly qualified. I immediately named your son and said so much in his favour that I was desired to write to him and acquaint him with the intended expedition...I was much pleased with the prospect thus opened for your son as he would be the first mineralogist ever sent out expressly by government, and as he would have to examine products of a country which hitherto has never been investigated he would become known and publick [sic.] character in science he would also be introduced into an elevated and valuable line of connection such as must be very desirable and advantageous to a young man...my recommendation of Mr Robert to the publick appointment which I have mentioned is the fullest proof of my opinion of his qualifications for having thus publickly made myself responsible which I certainly would never do for anyone merely from motives of private friendship.<sup>19</sup>

Jameson never took this opportunity.<sup>20</sup> It did not prove to be detrimental, however, to his career. Jameson received praise for work on local sites, which according to Dr. Fleming, had acquired a 'geognostical' character by 1804:

Professor Jameson, intimately acquainted with the geognosy of Werner, speedily began to group the rocks of the neighbourhood into their distinct formations, and to assign the relative position of our transition rocks, old red sandstone and the independent coal formation. This important step in the progress of our geology was followed by a system of prelections [sic], accompanied by excursions to the more important localities where the phenomena could be studied in the field, and produced a number of zealous observers, who have not only extended our knowledge of the structure and contents of this locality, but of the United Kingdom and its dependencies.<sup>21</sup>

Jameson seldom used fieldwork as a theoretical tool particularly before 1800, instead wishing most of it to remain within the confines of the descriptive eighteenth-century

---

<sup>17</sup> EUSC Gen. 129. Charles Hatchett to Thomas Jameson, 1801.

<sup>18</sup> A chemist, Charles Hatchett (1765-1847) was best known for work in mineral analysis. He was a friend and admirer of Jameson. Hatchett was a Fellow of the Royal Society (1797). Hatchett was a friend of Sir Joseph Banks. Richard Kirwan was also a friend and with Banks, he promoted Jameson to the chair of Natural History.

<sup>19</sup> EUSC Gen. 129. Charles Hatchett to Thomas Jameson, Jan 8 1801.

<sup>20</sup> For more on this relationship, see Chapter Three.

<sup>21</sup> Jameson L (1854), 21.

practice of Baconian fact collecting adopted from Walker. A clearer picture of Jameson's fieldwork and his activities as a traveller comes from his own diaries and field notebooks.

### 5.2.1 Early excursions, 1794 and 1796

Little is known about Jameson's early field experiences except to suggest that they did not contain any verificatory methods. This first detailed excursion was to Shetland in 1791 as Jameson had family connections in Lerwick. Although these experiences are not fully traceable because no diaries can be found, they may have further fuelled his interest in natural history and especially in using the 'field' as a place in which to develop and reinforce notions of the use of mineralogy and geology.<sup>22</sup>

In June 1796, Charles Hatchett arrived in Edinburgh from London.<sup>23</sup> He presented a letter of introduction from Dr Wavell of Barnstaple to John Walker, who had gained an intimate knowledge of the Highlands in several tours.<sup>24</sup> Walker offered to help Hatchett's proposed tour of the Highlands. Jameson, then Walker's assistant, guided Hatchett on his two-week Highland tour. The work Jameson undertook was included in his *Outlines of the Mineralogy of the Scottish Isles* (1800).<sup>25</sup>

### 5.2.2 Arran, 1797 and 1799

Jameson's excursions to Arran provided detailed records. Three visits were made between 1797 and 1799<sup>26</sup> and notes made in 1797 contributed to his (1798), *An Outline of the Mineralogy of the Shetland Islands and of the Island of Arran*.<sup>27</sup> Jameson arrived on the 20

<sup>22</sup> The only traceable inferences that can be from the Shetland expedition can be found in Jameson's eventual publication. See Jameson (1798) *An Outline of the Mineralogy of the Shetland Isles and of the Island of Arran*.

<sup>23</sup> Raistrick (1967), 83-103.

<sup>24</sup> Walker (1808).

<sup>25</sup> Jameson (1800), (1813).

<sup>26</sup> Jameson L (1854), 27. According to Laurence Jameson, it was his uncle's intention to produce published geological accounts of all the counties in Scotland. Laurence suggested that "his unwearied labours in the museum and the publication of a *System of Mineralogy*, fully occupied his time and therefore prevented him from doing more work in the field".

<sup>27</sup> Jameson (1798).

June 1797, and stayed for four days before moving to Ireland.<sup>28</sup> On return from Ireland, he stayed on Arran for a number of weeks.<sup>29</sup>

On Arran, Jameson visited Glen Coy and Kilmichael. Seemingly weary after his long travels, many days were spent recovering without observation. He complained of bad weather and took a week off: “confined by sore feet”.<sup>30</sup> On 11 August, Jameson – now recovered – set out to walk round the island with a Mr Walker where, whilst on foot, they came across outcrops previously observed by Hutton. Jameson notes: “discovered what Dr Hutton calls the Junction of Schistus and whin”.<sup>31</sup> Jameson did not offer any counter arguments or alternative suggestions on this occasion.

In the last week of his stay, Jameson’s trip was marred by unfortunate occurrences. On August 14 he was blessed with views of Jura, Islay, and Kintyre. He described stones thus: “[it was] an immense colossus of stones piled up by some monstrous giant who in former times may have waged war with the gods”.<sup>32</sup> The following day their geological endeavours were curtailed by a summons to appear in Brodick Court for an alleged assault on a local gentleman, Mr John Muir. They returned to Brodick only to arrive at an inn not to Jameson’s liking: “having arrived at the public house we flung into bed as we were with cloaks and not wishing to expose ourselves to the certainty of the itch”.<sup>33</sup>

Jameson returned to Arran in August 1799 where, in another journal,<sup>34</sup> he made notes for inclusion in *Outline of the Mineralogy of the Scottish Isles* (1800). He observed the shoreline cliffs composed mostly of breccia with basaltic veins. Crossing to the Isle of Bute, strata were also observed:

---

<sup>28</sup> For information on the mineralogical and chemical significance of Jameson’s Irish tour see discussion in Chapter Four.

<sup>29</sup> The work completed on Arran forms only a small part of the diary Jameson kept on his tour of Ireland. The original manuscripts are housed in EUSC Dc.7.126 entitled, *Journal of my Tour in 1797*. The work was transcribed by Sweet (1967b).

<sup>30</sup> EUSC Dc.7.126 August 4 - 10 1797.

<sup>31</sup> EUSC Dc.7.126 August 12 1797.

<sup>32</sup> EUSC Dc.7.126 August 14 1797.

<sup>33</sup> EUSC Dc.7.126 August 15 1797.

<sup>34</sup> EUSC Dc.7.129. *Notes of a visit to Arran in August, 1799*. The notes also contain a considerable amount of work on Kelp – mostly on Orkney and probably written after his visit in June-July 1799 (see Orkney chapter in this section). See also Vol. 2 of Jameson (1800), 242. Jameson also mentions Thomas Jameson’s work and Dr Black in *Trans Highland Society* Vol. 1 24, and Mr Kirwan in *TRIS*. Vol. 3.



---

Landed late in the evening at Mr Stewarts and having procured a man to carry luggage walked on about 4 miles to Rothesay the principle town (I beleive the only one) in Bute. The Strata all the way sandstone and sand Breccia traversed by Basaltic veins.<sup>35</sup>

Jameson procured a guide the next day that took him around the Isle of Bute. He observed the shore here, continuing to Kaimes Bay and, eventually, to the western part of the island where there were two slate quarries. He seemed more preoccupied with the aesthetic appreciation of scenery than mineralogical description: "The opposite mountains present a very rugged and grand scene ...the country however is beautiful with the seat of Mt Stewart and the wood along the coast add much to the beauty of the Isle".<sup>36</sup>

Jameson left Rothesay for Arran. Once there he procured his guide, who took him first to Lochranza. There he noticed a stratified appearance of the granite, relied upon by Wernerians as evidence to support the aqueous deposition of the rock. He again made no specific comments to suggest that this provided proof of theoretical concepts, but merely noted that the observation had been made:

Observed nothing particularly new until I came to Glen Sannicks. I however was more forcibly struck with the appearance of the granite upon several of the hills which presented a distinct stratified appearance and the strata either by being washed down by the rains seemed to surround the conical shaped summits of the mountain not unlike the leaves of an artichoke.<sup>37</sup>

Jameson then observed more strata previously "described by Dr Hutton in his work on the theory of the earth". Again, no attempt was made to divulge opinions about Hutton's interpretation, the description of the strata, or dip directions.

The following day, after having made a sketch of the strata, he set out for the Shiskin by Glen Catacol observing the granites and a red sandstone breccia. The sandstone strata continued for a considerable extent up the glen, in one place a vertical stratum or vein of sill appeared. Jameson encountered what he termed veins of basalt about five feet wide. He again mentioned Werner's theory but offered no interpretive or theoretical opinion:

---

<sup>35</sup> EUSC Dc.7.129 Friday [n.d].

<sup>36</sup> EUSC Dc.7.129 Sunday [n.d].

<sup>37</sup> EUSC Dc.7.129 Monday [n.d].

As to the great vein itself which I have described in the account of Arran [1798, p. 138]. I had now an opportunity of making several new observations, which will add considerable interest to the mineralogy of this curious spot. At first sight the part which is covered at high water, struck me as having more the appearance of the pitchstone being like strata inclined at from 30° and 60° but also the strata of the hard matter which bounded it on both sides having the same elevation and direction. A more complete examination demonstrated that these appearances were those of a stratified vein, as is the case with the lead vein at Argyleshire – and several similar appearances in Germany. It was upon these the celebrated Werner has found his interesting theory of veins.<sup>38</sup>

The vein was described in detail. After passing Kings-Cove, Jameson went on to the nearby shore and cliffs. Thursday began with a two-hour walk to Tory-Lin. The party then set out for Lamlash, and, eventually, Brodick Bay.

After resting in Brodick, the party set out for Lamlash. Walking first around the eastern side of the island, Jameson noted that it was composed of columnar basalt continuing for a considerable way up the bay. In the evening he returned to the mainland. Saturday being too stormy, Jameson resumed on Sunday, venturing out again to examine the junction of primary and secondary strata above the Cory Limestone. He left Arran the following day, heading for Saltcoats.

In summary, we see that on Arran, Jameson was aware of, and alluded to theoretical concepts but chose not to ‘explain’ phenomena but to employ fieldwork empirically, largely devoid of speculation or interpretation. This read rather more like a travel diary than the work of a ‘theoretician’ setting out with the express purpose of refuting Hutton’s theory. I will now show that a similar pattern emerged for his more extensive Hebrides tour.

### 5.2.3 The Hebrides, 1798

From May to August 1798, Jameson made a mineralogical tour of the Hebrides, his longest single tour.<sup>39</sup> His friend Charles Bell accompanied him as artist.<sup>40</sup> Jameson left from Greenock, travelled via Rothesay, Bell sketching quarries at Kames Bay. They first crossed to Tarbet and then to Jura, staying for three days.

---

<sup>38</sup> EUSC Dc.7.129 Wednesday [n.d].

<sup>39</sup> Jameson’s field notebooks are in 2 volumes EUSC MS Dc.7. 127 & 128 entitled, ‘Journal of a Tour through the Hebrides, begun 22 May 1798’. 2 Vols. The observations were used in Jameson (1800).

<sup>40</sup> Charles Bell (1774-1842), anatomist.

On Jura the party enjoyed the hospitality of the local minister Mr Macnicol, himself a keen geologist. They examined basalt veins and layers of micaceous schistus on the coastline. On Thursday 31 May, they walked to the Paps of Jura, which, after a difficult ascent, they climbed, Jameson describing the highest Pap as: “very precipitous on all sides”.<sup>41</sup> They left Jura on the morning on the 2 June bound for “Ila” [Islay] and the sound of “Portaskie” [Port Askaig].

On Islay, observing ‘Blew’ limestone on the way, the party arrived at Kiliru which was the seat of Campbell of Shawfield (Walter Campbell).<sup>42</sup> On 4 June, Jameson’s interest in the economic aspects of geology manifested itself fully. He set out early to explore a disused lead mine. Calc-spar, galena and copper pyrite were present amongst the ruins. He was most struck, however, by, a giant basalt dyke, acting as a natural sea defence for the shore houses. He travelled on from Mcerter’s head to Lugwillan when his sense of the unsightliness of the houses recalled Dr Johnson:

Here there are a few small wretched houses, the miserable picture of a village. Into one of these we were necessitated to repose ourselves for the night. The household furniture was good, but I might well say (but with more truth) with Dr Johnson that in endeavouring to get at an excellent [meal] I stuck in the mire.<sup>43</sup>

Further observations were made in the vicinity of Loch Daal. Having returned to the Ballena coffee-house, he struck up a disagreement on the nature of the local rock type with a previous observer, Mr Mills who was insistent that he was looking at chert.<sup>44</sup> On Friday 8 June the party left Islay, and returned to Jura.

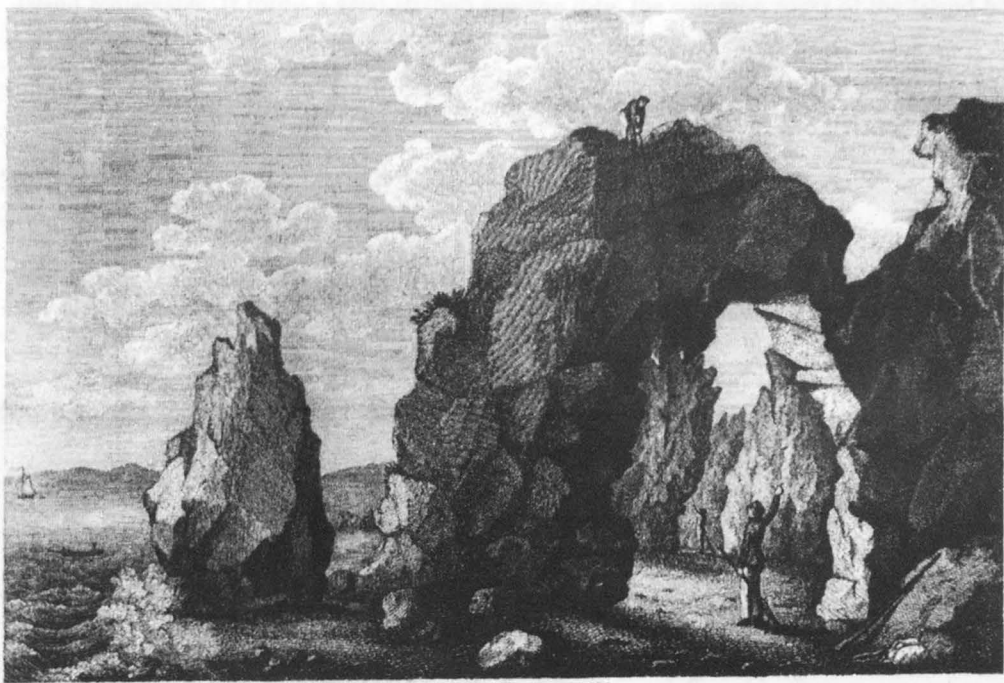
---

<sup>41</sup> EUSC Ms.Dc.7.127. May 31 1798.

<sup>42</sup> Jameson (1800), 150, fn.

<sup>43</sup> EUSC Dc.7.127. Monday 4 June, 1798.

<sup>44</sup> Jameson (1800), 157, fn. 2. Jameson acknowledges his disagreement with the geological observations of Mr Mills, “Mr Mills in his account of some strata in Ireland and Scotland, detailed in the philosophical transactions of the Royal society of London, 1790, has given a description of Isla. As it differs considerably from the observations I am now about to detail, it will be necessary as I proceed, to contrast our observations so that future travellers may be able to judge, who is in the right?”



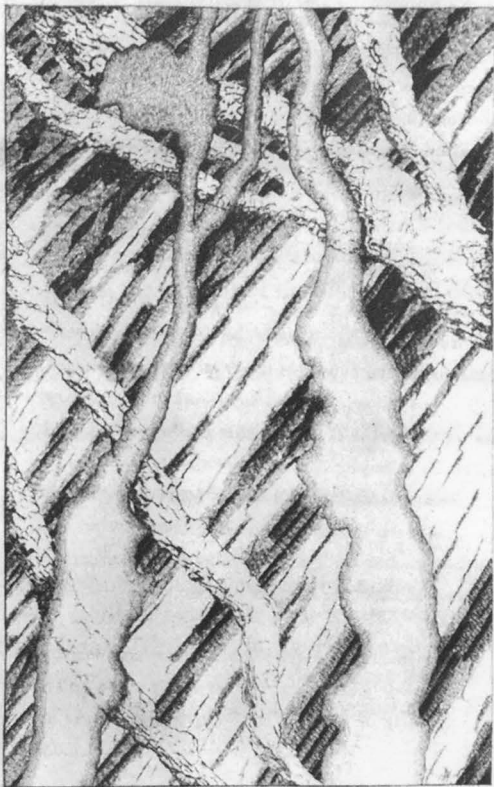
*View of a PERFORATED BASALTIC VEIN. N.W. coast of the*

Figure 4. Extract from Jameson’s *Outline of the Mineralogy of the Scottish Isles* 1800. Showing the party measuring a ‘perforated basalt vein’ on the Isle of Jura. Printed by permission of Edinburgh University Library.

It was not until June 15 that Jameson eventually set out for Achnacraig on Mull. Shortly after, his geological observations were curtailed by bad weather. They stayed in the area for a number of days, making accounts of the rocks where he observed “Breccia of quarts, [sic.] indurated marl, flint, mica schist”, returning “very much tired and fatigued”.<sup>45</sup> Owing to bad weather, no observations were made on Coll. After three days, they moved to Tiree. Jameson first encountered a marble quarry with peat workings that attracted his attention:

<sup>45</sup> EUSC Dc.7.127. Friday June 22 1798.

Immediately below the house of Balliphetre is the appearance of Marble which has made this Island remarkable. It forms a great stratum running thro' the common rocks of the Island being a mixture of Hornblende and quartz and in some places granite is in the immediate vicinity of the marble.<sup>46</sup>



GRANITE VEINS TRAVERSING MICACEOUS SCHISTS GLEN DRUMMOND BADENACH

Figure 5. Sketch of Granite veins from Jameson’s *Mineralogy of the Scottish Isles*, 1800. Printed by permission of Edinburgh University Library.

Jameson returned to the site the next day to make further observations. On Wednesday 4 July he explored the mineral structure where “immense blocks of gneiss” were observed. Eigg and Rhum were Jameson’s next destinations. After this the party went to Skye where he immediately tried to procure a guide to take him up the “Quilin [sic.] hills”:

Was promised the company of one of the girls that herd the goats, (a great beauty it was said) unluckily for us she thought again; whether the employment was disagreeable or our appearance,

<sup>46</sup> EUSC Dc.7.127. Monday 2 July 1798.

which was not of the most favourable kind, changed her mind, I know not but we were obliged to attempt it ourselves.<sup>47</sup>

They set out themselves and found the initial ascent wet and steep until they reached the bare pyramidal summits exposed only by rock. Their view at the summit was severely impaired by the adverse weather conditions. He was only able to observe basaltic structures that lay on the ground beneath them. Jameson could not observe strata at all, and was restricted to the basalts, 'bare and rugged':

Having gained the first summit, a wild scene was now before us; a rude, apparently inaccessible mountain side covered with debris of Basalt which lay scattered in wild ruin at its feet intermixed with the remains of strata of peat of here and here and there a few pools, marking the nat [sic] of the declivity of the season. The appearance of the catching lights upon the land far below, thro' the mist with difficulty we gained the summit of the hill, the rain pouring in torrents.<sup>48</sup>

Jameson spoke only of seeing basaltic structures on his walks on the western and northern parts of the island. He was impressed by the tall basaltic cliffs overlain by sandstones, but again was unhappy with the accommodation:

The weather having become boisterous, we were necessitated to remain here all night, being lodged in a black dirty hole; terrified from our beds by the abominable dirtiness. We early in the morning took the boat for Raasay. There are in the Highlands, as in other countries, places where strangers find bad accommodation; but certainly the inn at Portree has seldom been equalled for dirtiness; a traveller from the Hottentots may well recognise the Kraal, although so far removed from its customary situation.<sup>49</sup>

On Raasay he set about describing the rocks, noticing white sandstones containing fossil fragments and red cold Breccia traversed by basalt veins running in different directions. Having noticed that his compass had been effected,<sup>50</sup> he ended the day delighted with "our interesting expedition".

Back on Skye, Jameson spent the next two weeks making more geological and mineralogical observations. Aside from his empirical work, and anecdotes about the conditions of his stay, he also revealed a passion for the landscape. Near the end of his journey, he gave a romantic account of a view of Skye:

---

<sup>47</sup> EUSC Dc.7.128. Monday 16 July 1798.

<sup>48</sup> EUSC Dc.7.128. Thursday 26 July 1798.

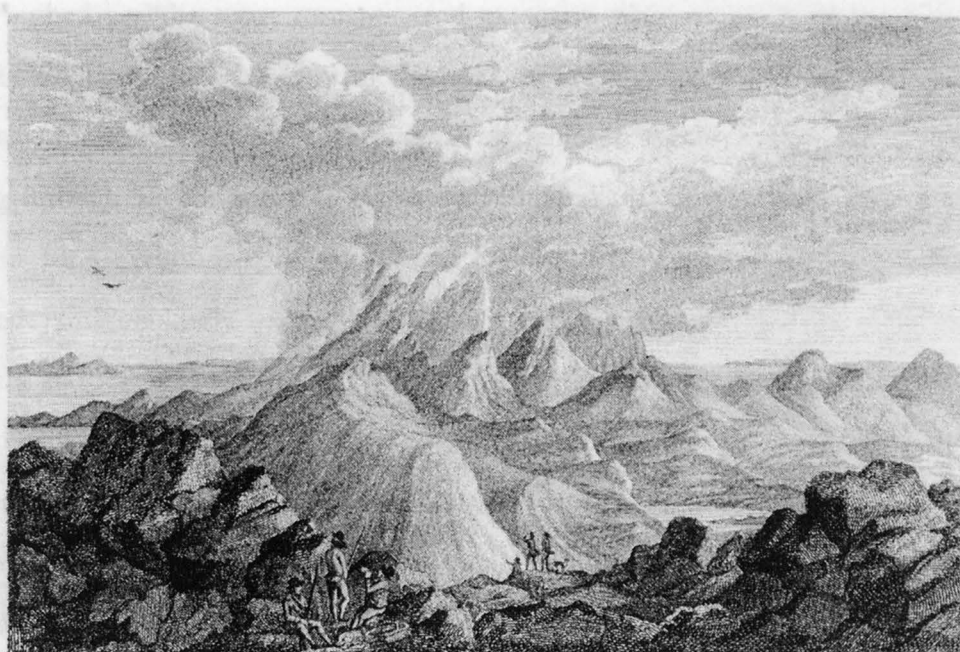
<sup>49</sup> EUSC Dc.7.128. Monday 30 July 1798.

<sup>50</sup> Caused by Magnetite in the rocks of Rhum.

Having scrambled with considerable labour over the loose stones which cover a great proportion of the mountain, we again come to a green spot which continues to the top of the mountain. Here there is a cairn, under which a tradition has placed an old Norwegian lady who was desirous of the prominent situation that the cold frozen blasts of her native country might play around her and certainly in this she was not mistaken. Here a scene of the wildest grandeur is presented to the astonished eye; and near us great glens bounded by sides reddened as if the powerful agency of fire and further torn by the furious torrents which collect here during storms. At a greater distance the dark, lurid Cuillin Mts rising in awful majesty among black clouds convey by this tremendous covering a vast idea of their bounds and raising in our minds the most truly sublime idea of the power and omnipotence of the framer of this wonderful globe.<sup>51</sup>

On leaving on August 14 Jameson said of Skye:

I have thus finished an investigation which afforded much pleasure, and altho' chequered with many difficulties, upon reflection, afforded a rich field for contemplation of the variety and magnificence of nature's works.<sup>52</sup>



VIEW from BEINN NA CAILLICH in SKYE.

Figure 6. Jameson's sketch of a scene on Skye from *Mineralogy of the Scottish Isles*, (1800). Printed by permission of Edinburgh University Library.

Again, Jameson's elucidation of the islands was not strictly Wernerian nor did his observations point to any notion of 'proof' gathering in favour of tenets of that theory. The lengthy anecdotes encompassed within, together with romantic expositions, point

<sup>51</sup> EUSC Dc.7.128 Saturday 11 August 1798.



to a natural philosopher part engaged in descriptive 'Grand Tour' notes and partly in specialised, mineralogical accounting. What Jameson had not fully alluded to - although he was aware of theory - was the use of his observations for explanation for theoretical purposes. This continued once on the mainland, where he continued his journey to Edinburgh on foot:

Left Island reach this morning on our way to Edinburgh, with sentiments of satisfaction from a conviction of having done as much towards the elucidation of the Islands as time would allow. Several parts were no doubt omitted but the particular views taken of the other three-quarters enable a pretty satisfactory conclusion to the peculiar nature of the unexplored parts. This will no doubt be thought a vague and indeterminate mode of description and it certainly has not the precision of the others but if they are only offered as probabilities, they cannot well be rejected too.<sup>53</sup>

The journey home took him through Glenelg, Glen Sheil and Fort Augustus. Glen Sheil was described as "the most romantic and extensive place as we have yet met with, bounded on both sides by lofty mountains...producing images of grandeur exciting impressive ideas of a most sublime nature".<sup>54</sup> Jameson recalls at the end of the day, walking through a "considerable extent of Muirland" [sic.]. The party then left Fort Augustus for Garvimore spending time at Dalnordoch where micaceous schistus was observed. Jameson's only speculative statement was a suggestion that the inclination of the strata and the mountains had been shaped by their decomposition. Again Jameson gave no explanation of what he meant by this. However it may be possible to infer that Jameson was thinking about vast 'scales' more akin to the theorist and not specific 'site'-based micro-scale features.

Jameson returned to Edinburgh with sore feet. His observations were eventually incorporated in his *Outline of the Mineralogy of the Scottish Isles* (1800). Jameson suggested there that the Hebrides expedition had not been as useful as he would have liked and certainly did not supersede "the work of others". It would appear that more detailed analysis of mineralogical features was his intention, rather than the wide-scale recording of Wernerian theory.

---

<sup>52</sup> EUSC Dc.7.128 Tuesday 14 August 1798.

<sup>53</sup> EUSC Dc.7.128. Wednesday 15 August 1798.

<sup>54</sup> EUSC Dc.7.128. Thursday 16 August 1798.



Jameson noted 'conditions' that he faced both in terms of accommodation and weather, the description of landscape features and anecdotes about local people with whom he stayed. It was therefore, part 'Grand Tour' and part 'science' for the purposes of mineralogical description. It can not be said to be either explanatory or speculative, despite Jameson's well-expressed views about Wernerian theory, but continued along basic descriptive lines. His next expedition was less of a success, however, a reflection of Jameson's lack of interest in the geology and very anecdotal in nature.

### 5.2.4 Orkney, 1799

In June and July 1799, Jameson made a tour of the Orkney Islands.<sup>55</sup> Once again he received hospitality from locals with the exception of a drunken minister from Ronsa,<sup>56</sup> and taverns not to his liking.<sup>57</sup> Jameson did not like Orkney and considered the tour less successful than the one he had taken just a year before. The homogenous nature of many of the rocks there meant that his records address more information of a non-geological nature. Some observations were made, however, suggesting a residual 'Grand Tour' rhetoric.

The journey to Orkney was taken by ship. The vessel sailed up the east-coast of Scotland arriving at the Pentland Firth on 20 June 1799.<sup>58</sup> The field observations began

---

<sup>55</sup> The manuscript journal is in EUSC Ms Dc.7.130 '*Journal of my Tour Thro' the Orkney Islands begun June 8<sup>th</sup> 1799*'. The diary entries were the forerunner for his (1800) *Mineralogy of the Scottish Isles* Vol.2. Jameson was away from June 8 to July 14. During the tour he spent more time making mineralogical and geological observations on the Scottish mainland. Here he began a long distance walk from Huna in Caithness to Firth of Forth.

<sup>56</sup> EUSC MS Dc.7.130. July 13 and 14 1799. Of Jameson's encounters with the minister of Ronsa, he records only that the minister was ever in a state of drunkenness. On the 13 July when he arrived on Ronsa Jameson recalls "Landed at the minister. He made his appearance some time after we landed but he seemed rather the worse of whisky". Again, on the last day before sailing back to the Scottish mainland he recalls: "Left the amiable Mrs Cragie with regret, but was still pursued by our mad cap minister. We crossed a ferry to the mainland...here the Rous minister took his departure but not before he was drunk".

<sup>57</sup> EUSC MS Dc.7.130. Jameson notes instances, whilst on his tour where his dislike for unclean places were recorded in his diary. He never spoke with disdain of the accommodation in Orkney. On his first night in Dysart he recalls, "Dined and supped in a vile Inn kept by a man Swyne – well named indeed". Similarly, shortly after landing on the Scottish mainland, Jameson noted that his stay in Wick, "remained all night with major Macleay. The public house kept by Sutherland is a vile dirty place" and in Helmsdale, "very hungry but could get nothing to satisfy our craving wants but whiskey and cakes in a hole as bad as a pig sty".

<sup>58</sup> EUSC MS Dc.7.130 June 9-20 1799. Amidst a violent tide, Jameson spoke of being tired of his voyage and companions. Upon arrival Jameson recalled the Mounts of Hoy partly cloud obscured, but adding to their grandeur and the picturesque scene of shipping extended up the bay.

the next day, with an ascent of 1000 feet to a headland vantage. Jameson then sailed to Flotta and to S.Ronaldsha [sic]. The landscape was low in elevation with rugged and broken-up cliffs of 'sandstone': he remarked how he:

went to the ferry place to Burra thro' the north part of the island and found the usual sandstone. The shores upon the sound of Burra are low...I walked around a considerable part of Burra but found only the usual sandstone...the island is low and the shores generally low...ret'd to Mr Watsons...Took a walk across the country to the West side. In our way observed a bed of shell marle...it did not extend many yards in any direction. Observed in many places bog iron ore: but on the whole the strata as usual sandstone.<sup>59</sup>

Jameson finally arrived on the mainland of Orkney on 25 June 1799. He visited Stromness where he passed the standing stones of Loda, and, shortly after, noticed a granite outcrop and slate quarry:

As we approach near to Stromness we have on our left hand some pretty considerable hills which lie upon the side of the Island stretching outwards. The rock all the way is the usual sandstone with sandstone flag and shistose clay. As we approach near to Stromness this disappears and at the entrance of the town there is a hill of Granite We cross over this hill, and after walking a short way the granite disappears a species of argillite appears and descends to the shore low towards the ministers house Mr Cloustone. N from this house the rocks on the shore low but rise gradually to the north where they form bold headlands. They are composed of slate which is to be observed in various slates from shistose or indurated clay to Ardesia.<sup>60</sup>

June 27 Jameson got his first view of the mountains of Hoy, ironically, the only view from which he appeared to derive any pleasure:

From the top of Orford Hill, a fine view of the mountains of Hoy, then brown furrowed sides striking objects of violence of the weather. In the openings between the mountains the far distant blew coloured mountains of Sutherland contrasted with the intervng [sic] sea and brown coloured hills of Hoy, form a most interesting and magnificent picture.<sup>61</sup>

Jameson then went on to Shapinsha where, in his diary entry for June 31 he recorded a visit to lime kilns at a quarry. Over the next few days, Jameson, not interested in the geology, lost sight of the reason he was in Orkney, concentrating instead on humanising his encounters by dining with friends and taking walks. He records one account of walking on a beach with many shipwrecks: "I have often been struck with horrid appearance of a bold rocky coast, yet the scene here seemed to impress up on me the

<sup>59</sup> EUSC Ms Dc.7.130. June 24 1799.

<sup>60</sup> EUSC Ms Dc.7.130. June 26 1799.

<sup>61</sup> EUSC Ms Dc.7.130. June 27 1799.

horrors of shipwreck”.<sup>62</sup> On July 7 he wrote: “As natural history is the principal object of my journey to this country, and as the fair sex are here most interesting productions, I here found something that was much in my way”.<sup>63</sup>

Not having done much that day apart from viewing more sandstone and heather and peat mosses, Jameson’s evening was also trying: “spent the evening as well as could be expected in company with a man newly married quarrlg [sic.] with his wife & speaking nonsense”.<sup>64</sup>

On 15 July, Jameson’s boat set sail for the Scottish mainland, where he parted with his friend Mr Watson, and headed for Huna and Dunnett Head. Once again, the party walked back to Edinburgh. Geological observations continued. On the first day the rocks observed bore resemblance to those seen on Orkney. The journey from Oakmast to Dunbeath was: “grey barren [and] sterile”, and “the tedious uniformity, the occurrence of old castles and recluse gentlemen left a melancholy but unpleasant sensation upon the mind”.<sup>65</sup>

Much of the next day was spent in meticulous mineralogical description upon a hillside immersed in fog. Jameson appeared, however, to have regained his enthusiasm for the empirical description of landscape. He noticed great masses of granite but was too far away to observe with certainty. On arrival in Dornoch after a difficult ferry crossing,<sup>66</sup> he was curious to have observed fragments of pumice along sandbanks, but did not comment further.

Jameson’s only reference to Wernerian theory comes late in his excursion between Cullen and Portsoy. From a mineralogical standpoint, this place excited him more than

---

<sup>62</sup> EUSC Ms Dc.7.130. July 3 1799.

<sup>63</sup> EUSC Ms Dc.7.130. July 7 1799.

<sup>64</sup> EUSC Ms Dc.7.130. July 13 1799

<sup>65</sup> EUSC Ms Dc.7.130. July [n.d.] 1799

<sup>66</sup> EUSC Ms Dc.7.130. July [n.d.] 1799. Here Jameson speaks with frustration at the difficulty in crossing to Dornoch, owing to the local ferrymen. “The ferrymen were fishing in the boat about twenty yards from the shore and altho’ the evening was far spent would not move until they thought proper, which was in about half an hour, and then the stubborn highland impudent idiots thought fit to ferry us across”. Upon leaving Dornoch, Jameson again expressed his annoyance with ferrymen: “we crossed the ferry and here again met with highland impudence”.

any other on the tour, a fact reflected in the length of its description.<sup>67</sup> Jameson found rocks composed of talc-schistus intermixed with quartz surrounding an old ruined castle once belonging to a Lord Oliphant. He also noticed quantities of serpentine and something he considered intermediate between quartz and hornstone, a talcaceous schistus and white marble. There was also an important vein structure:

[Stratum of serpentine is] bounded by hornblende rock which continues forming a rugged shore to the nearly second harbour of Portsoy. This hornblende rock is traversed in several parts by large veins of red granite, which run in different directions and vary considerably in their width from 1 to 8 or 9 feet. Some of the veins seem to spread out upon the surface, a fact quite consonant with the Wernerian theory. The rock, however are so much broken by the action of waves as to prevent me making any accurate observations on this curious subject.<sup>68</sup>

Aside from a few extra notes in the journal and a few pressed flowers, this was the last entry. It would appear that although Jameson was away for some time, he was only inspired fully by later geological outcrops. In general, he found Orkney to be homogeneous in nature and devoid of the complex vein structures that interested him around Portsoy. There is little to connect his travels to his theoretical persuasion save perhaps the last reference. It was a tiring trip with much walking in bad weather, and often with accommodation that was often not to his liking. A significant change occurred on his next tour, however, when his notes took a more theoretical turn.

### 5.2.5 Dumfries, 1802

Although Jameson's fieldwork never fully embraced in geological theory, he did not shy away from theoretical discourse within his travel accounts. The Dumfries excursion - Jameson's first since returning from Freiberg under the tutelage of Werner - demonstrates a written encounter with Wernerian discourse, in the field, with his identification of 'formations'. It may also mark the beginning of a shift in Jameson's approach to field geology: away from Grand Tour rhetoric based on anecdotes and aesthetic discourse towards more specific utilitarian and, partially, theoretical ends.

<sup>67</sup> EUSC Ms Dc.7.130. July [no date given] 1799. The description of Portsoy is the longest single diary entry on Jameson's Orkney excursion and is almost exclusively devoted to mineralogical observations.

<sup>68</sup> EUSC Ms Dc.7.130. July [n.d.] 1799.

Shortly after his appointment to the chair of natural history in 1804, Jameson published his first geological work based on these field observations. The *Mineralogical Description of Scotland* Vol. I. was the first systematic scientific description of any of the counties of Scotland.<sup>69</sup> The publication was dedicated to Werner and Kirwan whose “indefatigable exertions have contributed so greatly to the advancement of mineralogy in the British Empire”.<sup>70</sup>

Jameson began the section with a note on the position of the county and its ‘physiogomy’ [sic.], moving to a second section concerned with the consideration of different mountain rocks. After the general description, specific locations within the county were discussed. He began on September 7 at St. Mungo, a parish primarily composed of greywacke that was defined in Wernerian terms as floetz-trap formation, resembling Salisbury Crag in Edinburgh. After observing some ‘transition’ rocks of near vertical slate, Jameson noticed a mass of conglomerate. He then moved on to Brecken hill [Brakon].<sup>71</sup>

Unlike earlier excursions, it is clear from diary texts that observations made after Freiberg had more exacting terminology relating to Wernerian theory. By 1802, Jameson was classifying geological features theoretically rather than merely listing rock suites. An example of this is his walk from Annan to Thorn-Hill on 8 September, where he referred to the rocks as ‘transition’ and not mere ‘Slate’ or ‘Wacke’.<sup>72</sup> More emphasis was placed on the ‘mode’ of formation and on identifying rocks on a larger scale, as part of a formation, rather than upon description at a ‘single site’. On 9 September, in noticing a granite vein, Jameson’s language was again interpretive and set within a Wernerian schema:

The granite vein communicates with granite laying on the summit of the hill – the following sketch represents its mode of stratification. This granite I observed in great blocks on the roadside and on the side of the hills immediately after leaving Kenmore house and continues to nearly where the vein here mentioned is...the transition strata st.7 dip N.60°.<sup>73</sup>

---

<sup>69</sup> Jameson L (1854), 26.

<sup>70</sup> Jameson (1805), ‘Dedication’.

<sup>71</sup> EUSC Dc.7.130. September 7 1802.

<sup>72</sup> EUSC Dc.7.130. September 8 1802.

<sup>73</sup> EUSC Dc.7.130. September 9 1802.

Jameson then examined limestone quarries in the county. At Kilhead, Jameson gave a fine example of another method of categorising rocks, again using the language of Wernerian formations:

Near the bottom of Burnswalk [there is] flinty sandstone. Does it belong to Floetz trap or the independent coal formation? The transition strata in the vicinity of Burnswalk in a rivulet that runs into a milk strata 8 dip angle. Father down same burn str 9 Sth 65° still further down at st.8 dip sth 55°. <sup>74</sup>

Jameson observed veins in antimony mines at Glendenning and at Leadhills at Wanlockhead. This text was essentially mineralogical observation, Jameson listing all the ore minerals he saw. Of particular interest were the coal seams, Jameson recording that he was “examining the country with a view to ascertaining whether or not it contains coal”.<sup>75</sup> Having given a number of detailed sketches Jameson made observations about the coal using Wernerian terminology:

Thus it frequently happens that the floetz trap formation contains a bed of coal of great thickness...It frequently happens that the floetz trap formation is deposited over the independent coal formation which is still older but occurs in the same geognostical situations...It has to be said that wherever the old red sandstone occurs that coal is to be expected...the section which has frequently occurred of a tract of country on a discernible basis is composed of primitive rocks. On this it is to be expected [in] the old red sandstone.<sup>76</sup>

Although one cannot affirm with absolute certainty, it is unlikely that Jameson’s training at Freiberg led to the adoption of a slightly different approach to his interpretation of field observations. Apart from touching upon theoretical perspectives for the first time, Jameson again expressed an economic and utilitarian view of the rocks again, another manifestation of his extended mining training. Dominating his observations were coal formations. Despite theoretical discourse being included, Jameson was, by 1802, still far from fully embracing fieldwork for these purposes. This is particularly apparent with a view to work he carried out a decade later, work that purported to contain little theoretical input despite the strengthening of Huttonianism in Edinburgh.

<sup>74</sup> EUSC Dc.7.130. September 9 1802.

<sup>75</sup> EUSC Dc.7.130. [n.d.], 1802.

<sup>76</sup> EUSC Dc.7.130. [n.d.], 1802.

### 5.2.6 Mineralogical Walks, 1811-1816

Some years after Dumfries, Jameson studied Fife and Perthshire over a five-year period from October 1811 to March 1816.<sup>77</sup> Perhaps the most exciting and least known of his detailed observations were taken during these outings and they are the only known diaries written by Jameson whilst he held the chair of natural history. These observations were never published.<sup>78</sup>

His first notes in this context were made in the summer of 1811.<sup>79</sup> They were recorded meticulously and supported with his own illustrations. The notebook entries imply that Jameson was unassisted throughout. The narrative is descriptive and contains little mention of theoretical perspectives. This took place after Sir George Mackenzie's theoretical fieldwork in Iceland, a fact which indicates that Jameson was aware of the way in which others were using field studies. Jameson's work continued, primarily, as an empirical exercise in mineralogical description.

Jameson walked from Burntisland to the cliffs near Balfour's house at Kinghorn. Continuing his walk along the coastline from Burntisland to Aberdour with the view of examining the coast to Dunibrissal, Jameson spent a significant amount of time examining a greenstone-sandstone contact. Jameson next ventured out on the 27 October where he walked along the 'Bin' making a number of detailed sketches from the east-end of the 'Bin' towards Kinghorn. He then went to the lime district of Dodds head where he ascended the west face of Alex Craig. On October 29, Jameson took specimens of the vein of quartz at Ross Point, west of Burntisland. The vein was four feet thick and two and a half feet wide and traversed common greenstone. Jameson made reference to Hutton but offered no denial of Hutton's view, further supporting the notion that Jameson was not conducting fieldwork strictly to refute Huttonian theory:

---

<sup>77</sup> EUSC Dc.7.131.

<sup>78</sup> The text of Jameson's mineralogical walks in Fife - undertaken in stages between October 1811 and March 1816 - contain four hand-written diaries, EUSC Dc 131-134 (131 is from October 1811, 132 from October 1812, 133 from September 1813 and 134 is a single notebook kept for March 1816).

<sup>79</sup> EUSC Dc.7.131 beginning October 24 and ending October 31.

---

This appearance of the greenstone and met with a driving a gallery as reprecd [sic.] above would be considered a vein and Hutton would view it as a vein shooting from a subadjacent into a superincumbent mass.<sup>80</sup>

He returned to Edinburgh on 30 October 1811 and did not return to the area for a year.<sup>81</sup> By then Jameson appears to have become concerned with using fieldwork for the purposes of refuting Huttonian theory, an undertaking he had not previously adopted for field investigation, and which he may have done, with some hesitancy, methodologically.

He began at Kinghorn near Newbigging, noting beds of greenstone with layers of basalt. Particular attention was paid to each bed, devoting separate pages to each in the diary. Jameson's description of the fifth bed is a fine example of the new way he examined geological features. He was by now beginning to sound more like a Wernerian theorist:

Observed a good section of what I call the fifth greenstone. The lowest part of the section is the floetz limestone of the district. It is covered with a bed of bituminous shale which contains the beds of common clay and stone. On this rests a bed perhaps 4-8 inches thick of quartz sandstone, this is covered by a kind of earthy greenstone – on it rests a bed of bituminous shale with a kind of hard sandstone, the upper part a bed of greenstone, the lower part brown and earthy as usual. This bed of greenstone is to be seen for a considerable distance westward in the direction of the dachy quarries.<sup>82</sup>

Jameson then moved to a limestone quarry. The limestone here was described as being seventeen feet thick in places with bituminous shale as veins and intermixed beds. At 'Bin-end', he noticed a sizeable portion of trap-tuff within sandstone, likening it to a specimen from his Bohemian collection. He then described the east-end of the Bin, noticing sizeable sections of trap tuff. After examining 'the Craig', Jameson returned to the coast and cliff formations around a ferry place known as Petty Cur. Large sections of basalt and amygdaloid were noticed. There then followed an examination of the shore between Alexander's Craig and Petty Cur, where he made a rare reference to an observation that opposed Huttonian theory:

---

<sup>80</sup> EUSC Dc.7.131.

<sup>81</sup> Jameson's 1812 excursion diary is in EUSC Dc.7.132.

<sup>82</sup> EUSC Dc.7.132 The notebook contains no page numbers or dates until the very end.



The rocks on the shore from the SE end of Alexander's Craig are of trap formation. The lowest rock is basalt – in a few instances I observed below the basalt blackish coloured slate clay and mica as represented...the state given externally intersects with mica, bituminous shale and is sometimes in globular concretions. Below it limestone like that of Dodds head. Like bituminous shale petrifications would externally carbonise. It is not indurated by the amygd but covers it while it is in some place contained – appears rather a [?] formation with it and the idea which has some plausibility, in opposition to plutonic theory.<sup>83</sup>

For the first time Jameson, here broke with an established method of observing natural phenomena in order to deny Huttonian theory in the field. Whilst it is almost impossible to establish a precise reason for the action, it nevertheless represented a marked change in observing for the anti-inductivist purpose of refutation. He finished his examination of the area on 17 October 1812 with a set of observations around Kinghorn Loch and Dunvean house hill.

Another indicator of Jameson's fieldwork taking a slight theoretical turn for refutatory purposes came in September 1813, when on a visit to Glen Tilt and surrounding areas eastward by the River Dee, Jameson passed through the Ochils.<sup>84</sup> On reaching Perth, Jameson also made reference to the extensive walks to be had around the River Tay. Jameson headed for Dunkeld observing red sandstone. Using Wernerian terminology to describe roadside features, he stated that here he had seen the last of the Floetz rocks that had been procured by primitive clay slate. Jameson described Dunkeld as the "entrance to the highlands – beautiful boundary hills of considerable height".<sup>85</sup> Gneiss and porphyry were the dominant rocks.

Knowing that Hutton, Hall, Playfair and Mackenzie had signalled the area as a type site to confirm ideas about Hutton's theory with reference to veins, Jameson arrived in Glen Tilt to "examine the various mineralogical aspects" of the area. According to Jameson, the area was composed mostly of a beautiful variety of micaceous gneiss. On walking through the Glen, he observed many beds of limestone that had decayed. Like Hutton and Mackenzie before him, Jameson also described the veins of quartz. Acknowledging Hutton and Playfair's previous visit, he offered contrary

<sup>83</sup> EUSC Dc.7.132 Section entitled "Petty Cur".

<sup>84</sup> The mineralogical diary of the 1813 excursion is in EUSC Dc.7.133. Jameson's diary, although forming part of a series entitled "Mineralogical walks in Fife" was the only diary where Fife was not the area examined. Instead Jameson explored mineralogical features in and around Perthshire, eventually returning to Edinburgh where he made further field investigations near Roslin and in the Pentlands.

opinions of the rising of quartz veins: another rare entry for Jameson who usually refrained from mentioning the opinions of others on mineralogical and geological matters in his field notebooks:

Remembered several of the beds of quartz in the gneiss or mica slate in our course upward. Again viewed the great bed of syenite which Dr Hutton, Prof Playfair and Sir James Hall maintain to be veins – one fact is decisive again that [opinion] is that this does not rise through the faults as is the case with veins – on the contrary it has nearly the same level all along and is everywhere covered.<sup>86</sup>

On August 26, Jameson travelled to Glen Shee noticing that granite and porphyry were less extensive. The following day he walked along the road following the Dee, observing gneiss as the prevailing ‘strata’. The following day Jameson went to the Spittal of Glen Shee, climbed to a summit that bordered Perthshire and Aberdeenshire and arrived at Blairgowrie in the evening. The party then returned to Edinburgh.

Following the Perthshire excursions, Jameson’s field diary is full of observations in and around Edinburgh.<sup>87</sup> Having spent a day at his house in Roslin, Jameson took to the Pentland hills:

This day being fine I began my re-examination of the Pentland hills. Examined [Kirk yettan] the lowest part of the hill porphyritic amygd [sic] and basalt – in the upper part besides the porp amygd also claystone. Observed frequent tuffa and sometimes porphyritic also inclined to compact feldspar.<sup>88</sup>

After spending several days examining features of the further part of the range in Glen Loggan, Jameson returned on Monday 6 September to re-examine “several of the nearer parts of the range”. He examined this area for over a week.<sup>89</sup> Jameson was very familiar with this location - his diary entries are extensive. Jameson’s next diary entry was recorded in March 1816 and was considerably shorter.<sup>90</sup> Even in 1816 there was

<sup>85</sup> EUSC Dc.7.133 [n.d. possibly August 23].

<sup>86</sup> EUSC Dc.7.133 [n.d. possibly August 23].

<sup>87</sup> These field investigations may have been taken in the presence of students although there is no conclusive proof to suggest this was so.

<sup>88</sup> EUSC Dc.7.133. [n.d.] August 31.

<sup>89</sup> EUSC Dc.7.133. Jameson’s notes on the Pentland hills clearly reflect his familiarity with the geographical location of the Pentland hills. He spent a week in the vicinity, examining geological features in detail.

<sup>90</sup> EUSC Dc.7.134. Less work was done here, the journal being very short. It contains extensive notes in neatly hand-written script about Sir Joseph Banks’ world voyage. It is difficult to tell whether this is in Jameson’s handwriting. Judging by his usual hand style it would seem not. The text is about eight pages long and appears at the rear of the journal.

evidence of theoretical underpinnings to the observations, perhaps to counter that ever-mounting array of Huttonian evidence which had been begun as early as the 1780s. I now focus on the fieldwork of the Huttonians and identify differences with Jameson's observations.

### 5.3 Early Huttonian Fieldwork: Sir James Hall, 1781-1791

James Hutton had formulated aspects to his theory of the earth by the beginning of the 1780s. Awareness of its possibilities as a credible formulation had been soon realised. Even though Huttonian theory was in its early stages, the beginnings of the accumulation of corroboratory evidence can be seen in the field through the observations of his contemporaries, in particular, of Sir James Hall.

Sir James Hall's fieldwork can be thought of as one of the last expressions of the Enlightenment 'Grand tour'. His travels took him across Europe encountering the volcanic regions of the Mediterranean. They perhaps represent one the earliest examples of the emergence of corroboratory evidence collecting through field observation.

Hall's tours were significant because a considerable portion of his journeying was devoted to the description of natural landscape and, more importantly to the observation and recording of geological phenomena.

Sir James Hall's early travel diaries reveal a passion for geology. Hall developed an interest from an early age. James Hutton was a friend of Hall's father, John, who frequently made visitations to the family estate of Dunglass, not far from Hutton's in Berwickshire.

Hall revealed experiences of observing scenery (especially active volcanism), of meeting with people engaged in experimental techniques as well as development in the social and political spheres of his life. Hall also took part in many chemical experiments that he later adopted for use with his own ideas: the life in experimental geology and his

major contribution to the geological community in Edinburgh was a direct result of these early experiences.<sup>91</sup>

Hall's first tour took place in 1781. Although only limited records survive, they show that by the age of twenty, Hall was enthused by his surroundings, a trend that continued and increased in time.<sup>92</sup> His travels began in earnest two years later when he and Lord Daer set out from Edinburgh on a three-year voyage that would take them first to Eastern Europe and then to the Mediterranean.<sup>93</sup>

---

<sup>91</sup> I will concentrate here on Hall's field investigations. For more information on his early encounters with experiments whilst on the grand tours and his relationship with Lavoisier, see Chapter Six.

<sup>92</sup> NLS MS ACC 4616, 7-15, April 1781. Only a photocopy of a portion of the 1781 journal exists and in this short piece there is no mention of anything that could be considered 'geological' activity. His concern is the description of the French countryside whilst out horse riding and his meetings with friends and colleagues, on social and political matters rather than scientific.

<sup>93</sup> NLS MS 6324 – 8. The diaries of Hall's three-year journey are in five volumes without subject categorisation. No. 1, MS 6324, Edinburgh - Vienna 9 May 1783 - 30 April 1784. No. 2, MS 6325, Vienna, 30 April 1784 - Geneva 1 Sept 1784. No. 3, MS 6326, Geneva 1 Sept 1784 - Rome Feb 25 1785. No. 4, MS 6327, Rome Feb 25 1785 - Palermo May 5 1785. No. 5, MS 6328, Palermo May 5 1785 - Paris (no date). A general account of Hall's movements show that he made his way to Vienna via France and Germany where he remained for the winter of 1783-4. He then made a small excursion to Hungary. Hall then returned briefly to Vienna in April 1784. He continued his tour, passing through Italy and Switzerland. From Switzerland Hall went into France and then back to Italy, arriving in Rome in November 1784. He remained in Rome throughout the winter, leaving for Naples in February 1785. Hall then left for Sicily until the end of June 1785 and then went to France where he spent a year before returning to Scotland in the summer of 1786 (August). A full account of the journey does not exist. It must only be assumed that Hall continued to write during his homeward leg from Paris to Edinburgh in the summer of 1786 but that it has been lost. Details of Hall's destinations on the 'Grand tour' can also be found in Eyles (1963), 158-170.

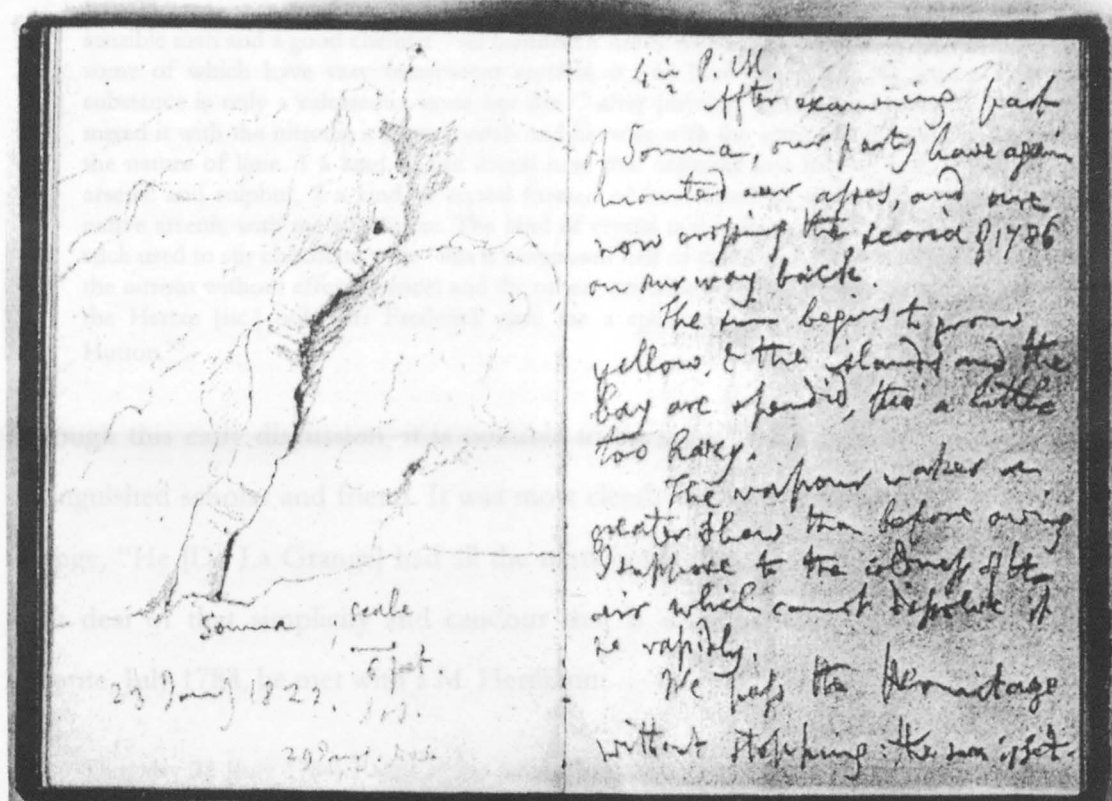


Figure 7. Extract from Hall's diaries showing notes and sketch of a volcanic dyke. NLS MS 6325, Printed by Permission of the National Library of Scotland.

The party left in the summer of 1783 but not until 1785, when Hall entered the volcanic region of the Mediterranean, did he become fully impassioned with geological matters. This interest in volcanism and heat may also have contributed to his interest in the use of furnaces for experimental purposes.<sup>94</sup>

Hall did, however, have prior geological interests as early as July 1783, engaging himself predominantly through discursive means. In July 1784 he described a meeting he attended, the purpose of which was to examine a number of specimens, one of which he thought would be of use to Hutton:

<sup>94</sup> This section will deal specifically with the theme of Hall's geological activities. It must be noted that Hall was engaged in other scientific pursuits that have been largely omitted here. Hall was a committed chemist: description of his experiences with Jean Ingen-Housz in Vienna (1784), and Lavoisier in Eyles (1963). Eyles does not concentrate on Hall's geological pursuits. He says, "Little that has any bearing on the development of his ideas about chemistry is recorded either in his letters or in his diaries for some considerable time, although there is much to indicate that his interest in geology was very active", 163.

July 29, went with the Baron's son and [Rederie] to see Mr Christopher's collection of fossils - a sensible man and a good chemist - all manner of ores - many specimens of the gypsum and the [?] some of which have very transparent crystals, it had been a [?] that the earthy base of this substance is only a calcareous stone but Mr C after [driving] efforts by heating it with charcoal mixed it with the nitrous, it gives crystals and likewise with the spirit of salt which is by no means the nature of lime. 1 a kind of ore found here that contains one half of pure silver, the rest is arsenic and sulphur, 2 a kind of crystal formed of lead, fixed air and a little vitrifiable earth, 3 native arsenic with metallic lustre. The kind of crystal is the shape of a cross something like the stick used to stir chocolate with - this is composed half of calcareous earth without air (as it dips in the nitrous without effervescence) and the other vitrifiable earth's. These last minerals are found in the Hartze [sic.] only, Mr Frederick gave me a specimen of each which I will keep for Dr Hutton.<sup>95</sup>

Through this early discussion, it is possible to decipher Hall's respect for Hutton as a distinguished scholar and friend. It was most clearly noted when he met with M. De La Grange, "He [De La Grange] had all the marks of a man of first rate genius...he had a great deal of that simplicity and candour that is so remarkable in Dr Hutton".<sup>96</sup> In Lucerne, July 1784, he met with a M. Hermann:

Thursday 22 [July 1784] I supped at the table d'hôte, met by accident with a M. Hermann who had spent two winters at Edinburgh and who is intimately acquainted with Dr Black and Dr Hutton and Robison. He seems to understand the genius of them all thoroughly, I am sorry he leaves us tomorrow morning.<sup>97</sup>

From an early stage, Hall was well acquainted with current notions of earth theory. When in Brandebourg [sic] on August 8 1783, he spoke of the interpretation of features through the use of theoretical language, noting geological features as 'formed' and interpreted on larger, macro scales:

[There is] a quantity of large stones of various kinds of granite and roche [?] a stone with a number of round-ish parts harder than the rest that I take to be garnets. I tried to break off some but broke it all in the middle; this whole country seems to have been a vast shallow sea.<sup>98</sup>

In the style of a Grand Tour based on personal self-improvement, much of Hall's diaries consist of the romantic description and appreciation of landscape. There are few detailed encounters of specific or small-scale geological phenomenon. This was particularly so when Hall entered the Swiss Alps in June 1784:

---

<sup>95</sup> NLS MS 6324 f. 22.

<sup>96</sup> NLS MS 6324 f. 53.

<sup>97</sup> NLS MS 6325 f. 152.

<sup>98</sup> NLS MS 6324 f. 48.

Saturday 3<sup>rd</sup>, off early in the morning to ascend Jura. We saw Mont Blanc in all his majesty, I never saw his pre-eminence so strongly marked - the three peaks rose remarkably above the cloud that covered the lower parts and all the neighbouring hills<sup>99</sup>...Sunday 11, the place we had is a romantic spot the [mass] of stones is not above ten yards wide it is shaded by a fine oak and enclosed all round by woods and precipices on all sides.<sup>100</sup>

And in Switzerland, in August of that year:

I rowed over to a field about twenty yards above the level of the lake surrounded with Green wood. Besides its being [classic] ground it has the merit of being the most picturesque spot I think I ever saw. Friday 6<sup>th</sup>, off at nine along the river [I] entered the most romantic wood I ever saw. The hills of granite or rather a very rough kind of roche formed great blocks rolled with torrents and avalanches...rugged hills covered with wood - the finest scene I ever saw. Sunday 15<sup>th</sup>, ...I got into the town in time enough to take a walk in plain palias - this is one of the finest sights in nature.<sup>101</sup>

It would appear, however, that Hall, very soon, drifted out of landscape descriptions and evinced signs of empirical geological investigation. Hall's next geological encounter arose in September 1784 when, on his way to Geneva, he noticed a sequence of familiar-looking strata. This marked the beginning of a period of more frequent and specific geological sightings:

Before I reached [Frejno] I had asserted several strata of the earth strongly impregnated with iron of a very dark red. Here I saw an appearance of the same kind of stone exactly like that of which the basaltes of Dunbar are formed, naturally red and decomposed in white spots and stripes. I began to climb the hill called estrelles, it consists of a mass of hills thrown together it begins about three or four miles from Frejno...I saw several things which made me suspect that the hill was an extinct volcano, in one place I saw a rock fairly formed into basaltic columns. I saw numerous stones that as far as I can judge were lava's and basalt's of the purest kind, like that of Arthur's seat. I saw some several masses of quartz and roche [fenilte] but these were detached and in some places inclined in what I thought looked like volcanic matter. I came to Wapoule I found the post house built of such variety of stones that no two appeared to be alike. in general they looked like lava's and fine hard basalts of various colours and some were granit and some were pure jasp. I broke off three pieces of the most remarkable to show to those that understand the matter or to examine myself shew I am better aquainted with the subject.<sup>102</sup> In general the country has the appearance I expect to see in a volcano. Black rocks and crossed with deep red and blue and a great quartz of clay probably from a decomposition of lavas, in some places calcareous rock.<sup>103</sup>

It was not until early in 1785, when Hall arrived in the volcanic region of southern Italy, that Hall's geological observations were manifest fully.

<sup>99</sup> NLS MS 6325 f. 108.

<sup>100</sup> NLS MS 6325 f. 120.

<sup>101</sup> NLS MS 6325 f. 212.

<sup>102</sup> NLS MS 6326 f. 73.

<sup>103</sup> NLS MS 6326 f. 174.

### 5.3.1 Volcanism: The Mediterranean

In February 1785, Hall first set eyes on Mt. Vesuvius,<sup>104</sup> alerted in a letter by a Mr Clarke to an extraordinary heat smoke on a part of the mountain to which he heeded advice.<sup>105</sup> On 27 February, Hall and a party set out to observe the mountain, seeing an active volcano for the first time. They travelled from Rome: “we saw Vesuvius pretty clear and set out at 12 o’clock...we left our mules after riding an hour and climbed up a bank of [volcanic] matter and came to the great cone of Vesuvius”.<sup>106</sup> Engulfed by sulphurous smoke they were, at first, suffocated, but eventually got used to it. Having reached the crater, Hall described the action of scoria and noted the existence of explosions at two-minute intervals.<sup>107</sup>

On 13 March, Hall made another attempt on Vesuvius, this time with Mr H [Home] and Mr A [not mentioned] who had come from Rome: “I wrote to Mr H telling him about the fluidity of the lava”.<sup>108</sup> This time Hall made detailed accounts:

I had the opportunity of observing the formation of pumice in a gross way on this and other occasions, a quantity of matter is resolved into the state of vapour...at the time that the lava begins to become vitreous as one sees it sometimes in the stones that have been blown out from the volcano, those parts that have been melted into the glass if they have formed and have remained solid but near the surface the volatile matter has expanded and forced the glass out which one often finds on the stone.<sup>109</sup>

Later work that was to dominate Hall throughout the first part of the nineteenth-century involved his interests in the textural gradation of rocks via the action of variable cooling rates from a melt. It is on Lipari that he first spoke of the explanation of this phenomenon regarding pumice:

By the description and by the place of the quarry of solid pumice’s (the only one hence, perhaps in the world) this must certainly be the lava spoke of in the commander Dolomieu’s book. What he says of the gradation from glass to heavy pumice is perfectly just and the discovery does him the greatest honour but he seems to have carried it a little too far and to have the operation more compleat [sic.] than it is upon this spot. At least he found the operation going on in its middle state and he has supposed that the extremes as far as I remember. Distinctly he says in his book

<sup>104</sup> Also mentioned in Eyles (1961), 163, but without detail.

<sup>105</sup> NLS MS 6327 f. 1. From this period on, Hall’s interests turn very much in favour of geological topics and description revolved around volcanic phenomena in the region.

<sup>106</sup> NLS MS 6327 f. 3.

<sup>107</sup> NLS MS 6327 f. 3.

<sup>108</sup> NLS MS 6327 f. 17.

<sup>109</sup> NLS MS 6327 f. 17.



that there is an insensible gradation here from granit [sic.] to pumice, however we looked all over the lower part of the lava indeed all over the Island without finding anything at least like granit [sic.].<sup>110</sup>

Despite this interest, the most important arena for Hall's geological interests was clearly Mt. Etna. He spent two months there, undertaking two separate expeditions to conduct geological observations whilst circling the entire mountain and scaling its summit. Hall arrived in Catania on May 18 1785: "the day was clear and the mountain appeared distinctly with much snow on its top - it has not the appearance of rising so high as it really is between us and the mountain".<sup>111</sup> Hall's observations began in earnest the next day, with his observing the mass of secondary strata exposed on the western side of the mountain.<sup>112</sup>

Throughout this time in the Etna region, Hall made constant reference to the effect of water on the surroundings, exposing early diluvialist tendencies and one of the few areas where he disagreed with Hutton's theory:

June 1<sup>st</sup>; it is [Etna's lower regions]...covered by a strata of volcanic matter and that again by calcareous stratum this proves incomprehensibly that volcanoes were in action [when] the level of the sea was 100 fathoms higher than it now is and that operations forming volcanic and calcareous strata went on at the same time.<sup>113</sup>

He later refers on his second trip with Commander Dolomieu to similar occurrences:<sup>114</sup>

200 yards on from this towards Catania on the right side of the road I found a bed of clay that certainly lies on the lava's and that contains very great quantities of sea shells in a very perfect state, many of them are primitive cockles and the [cher G] shewd us a nautilus that he had found and broke a another. This proved beyond a doubt that the seas had been here at some period in a settled state for a [nautilus] is not a shell that would bear being carried from any distance - this place is at least two or three hundred fathom above the level of the present sea and immediately behind the Trezza and the Cyclopiian Islands. This is very strong confirmation of the conjectures that we made on seeing the rocks below - seem to prove that this part of the base of Etna is coeval with extinguished volcanoes of the Val di Nito and it is more than probable that the same kind of rocks exist all round the base of Etna but covered by recent lava's.<sup>115</sup>

<sup>110</sup> NLS MS 6327 f. 142.

<sup>111</sup> NLS MS 6328 f. 132.

<sup>112</sup> NLS MS 6328 f. 135.

<sup>113</sup> NLS MS 6328 f. 154.

<sup>114</sup> NLS MS 6328 f. 176. Hall's second expedition in the Etna region took place between June 9 and 19 1785. He was accompanied by Dolomieu throughout.

<sup>115</sup> NLS MS 6328 f. 178.

Hall made a trip to the summit of Etna, accompanied by Commander Dolomieu. He also made frequent visits to the coastal regions, and completed a full circumference of the mountain.<sup>116</sup> He says: "Saturday 18 [June] we parted from the Commander with no small regret - he was obliged to [go] back to Catania and he gave us directions for the next part of our Journey, our business now was to compleat [sic.] our circuit of Etna".<sup>117</sup> The following day Hall had completed the full circumference much to his delight:

Sunday 19<sup>th</sup>, we looked upon our tour of the mountain as compleat! On return to Pandazzo the circuit of the greatest extent of the lava's of Etna may be made out by the computed distances between the different towns that lie near the extremities of the lava's. From Catania - Paterno 12; Adorno 12; Bronti 12; Randazzo 14; Linguagropa 18; Piedmonte 6; Giari 12; Jaci Reale 9; Trezza 3; Catania 7. Allowing for addition in some towns where the lavas extend beyond the line formed by these towns and considering the error of computation I think one may say with certainty that the truth lies between 100 and 10 miles. This circuit comprehends the encroachments the mountain has made on the neighbouring country.<sup>118</sup>

Hall left for Paris at the end of June 1785 and returned home to Dunglass shortly after. He did no further geological fieldwork in Europe until he travelled again six years later. The 1791 tour was to France only and began on 19 April. His diaries cover the period 3 April to 7 August and show a desire to record scientific phenomena of interest to him. It was, however, not as 'field' based as his previous European excursion this time, being more ethnological and discursive in nature.<sup>119</sup>

Hall was a keen observer and wherever he went on his travels both at home and abroad he sought to meet and talk with those who could furnish him with any information that he might require. He seems to have been accepted in the homes, workshops and factories of scientists and industrialists alike and he was careful to record his impressions of people and things that he had seen on his travels.<sup>120</sup>

<sup>116</sup> NLS MS 6328 f. 178.

<sup>117</sup> NLS MS 6328 f. 210.

<sup>118</sup> NLS MS 6328 f. 212.

<sup>119</sup> The four diaries of Sir James Hall's visit to France exist in NLS MS 6329-6332. 6329, Dunglass (Scotland) - Paris, April - May 1791.xv + 163ff. 6330, Paris, May 1791.x + 176ff. 6331, Paris - Clermont, June 1791.xii + 226ff. 6332, Clermont - Dunglass, July - August 1791, xiv + 251ff. Hall made abbreviations in his diary, and, giving each category a letter, he placed them in a separate column. They are recorded as the following; (P) politics; (F) fine arts; (U) useful arts, agriculture and manufacture; (S) science; (I) remarkable incidents; (M) society, characters of men; (E) political economy; (A) anecdotes; (H) husbandry; (V) view, picturesque face of a country; (N) natural history; (B) buildings, towns and castles; (C) countryside. From a total of 1438 entries in the four diaries covering the tour, Hall made 427 entries (29%) on *political issues*, 260 (18%) on descriptions of meetings with friends and colleagues and 215 (15%) on *husbandry*. His scientific entries totalled only 56 (4%) with *natural history* a little higher at 97 (6%) and of this 10% combined, geological topics made up no more than a handful, none of which were theory based.

<sup>120</sup> Chaldecott (1968), 21.

Hall's chief interests on the 1791 tour were social, political and agricultural. His few geological encounters in the field make it nevertheless worthy of our attention, since, despite accounts from historians on Hall's 1791 tour, the few field observations he did make have received no study.<sup>121</sup> There were, however, instances where Hall made quite lengthy geological descriptions of phenomena on his few excursions outside Paris. The descriptions clearly demonstrate that every available outcrop or quarry was observed.

Hall's first lengthy geological field observation came when on a visit to the country home of La Rochefoucauld, where he was a guest on 22 May. The home was forty miles from Paris [Larochegion] on an exposed bank of the river Seine where outcrops of chalk and clay lay exposed. Interest in the exposure captured Hall's imagination and seemed to take him further and further upstream. On the 22 May all thoughts (and certainly diary entries) of political issues were relegated in favour of geology:

Sunday 22<sup>nd</sup>. Walked with T [M. Terray] saw some of the chalk and flint cliffs, horizontal injections of flint - very curious. The flints are deposited through the chalk in beds that were quite horizontal. In the beds they are generally in nodules of various sizes with a tendency to roundness as if the whole bed had been in one mass [with] the fluid and that these nodules had separated by an operation like that of the formation of the drops of oil on the surface of water. In some places these nodules touch and form together one irregular continuous mass as if the oily separation had been completely formed. In several places we saw plates of flint as filling up cracks in the chalk - these plates are from the length of an inch to three or four inches thick. They terminate in even straight lines and taper to the finest points as if filling cracks. They frequently branch, making angles together - their position is generally nearly horizontal but they sometimes lie obliquely. These horizontals are disposed at such intervals and with such regularity as gives to the mass a complet [sic.] appearance of stratification and the look of the chalk itself when closely examined favours this opinion as there are visible differences in its substance which seem to continue horizontally. I am induced to think that the present position of the flints has some connection with stratification either in lying between beds or as having a connection with the chemical nature of some of the beds themselves. The houses here are built with a kind of stone that seems to be the same as the chalk only that it is harder - in one of these I saw a flint evidently broken with the piece detached at a little distance in the stone with the interval filled with the limestone as the fracture of schist are filled with granite. This seems to prove that the flint was hard or at least had consistency enough to retain its form and its angular fracture while the limestone was in a liquid state. I shall enquire from the quarry this stone comes from.<sup>122</sup>

<sup>121</sup> Current literature that refers to Sir James Hall's 1791 tour is scarce: see Green (1964), Chaldecott (1968), and Eyles (1963). The latter devotes only a section of his paper on the 1791 visit (177-180) and refers mostly to Hall's contact with Lavoisier in Paris.

<sup>122</sup> NLS MS 6330 f. 79-80. Immediately following this entry a further quote was added dated October 20<sup>th</sup> 1825, 39 years after Hall's original observation. It reads: "it now appears to me after many examinations of cases where a meeting takes place between limestone and flints that a secretion and separation between the two has taken place producing an array of peculiarities visible at which they are taken at the same place during the act of slow cooling and which I hope in time to imitate in our experiments. A process of

On Tuesday 24 May, Hall then extended his observations of the chalk and limestone scenery:

This country seems to exhibit a set of gradual transitions from chalk to firm limestone and shows pretty clearly that chalk differs from the calcareous [shore] only in degree of some circumstance and is divided abruptly from the rest either in fact or in theory but that chalk is like them a stratified mass.<sup>123</sup>

Hall returned to Paris on Friday 27 May where geology was abandoned for politics. Not until Hall again ventured from Paris did he engage in geological matters. At Champalary on 17 June, he was shown a quarry site. Here, Hall discovered a junction of granite and gneiss about which he was able to infer nothing.<sup>124</sup> It is, however, an early indication of theoretical leanings:

Walked out with a Gentleman , M Cornaud, who took us to his house and showed us a map he has made of this country and pointed out upon it the bounds of the granite and gneiss...I think with granite - he told us that in several parts of the country sandstone and coal and limestone were found to surround the gneiss's and we should see a mass of this kind on our way to Clermont - I account for this easily by supposing that these masses are fragments of the strata that all over the country covered the schistus.<sup>125</sup>

On the 19 June, Hall discovered another exposed site where his observations moved beyond empirical description to speculate upon modes of formation:

From this we went to examine the rock of the Strata near the river and followed down the river until we came to granite. We endeavoured in vain to find the actual junction so as to determine to a certainty whether the granite or the strata was the first comer. It appears however that more than likely that the strata of sandstone have been formed after the granite existed as a mass, for many of the strata are evidently composed of sand produced by the wearing and decomposition of granite, that their mass is not at first sight to be distinguished from it and the strata near the junction contain quartzite's and fragments of granite some rotted, some rounded, some angular.<sup>126</sup>

Hall compared his observations to previous experiences of Europe and Scotland. On that same day, shortly before reaching the village of St. Hillaire, he and his party

---

this seems to have gone on in the formation of agates in our Whinstones which [are] spherical agates. Nodules of calcareous spar occur in the caves of Mt. Vesuvius. Also the crystalline forms whose assemblance constitutes the entire mass of granite. A similar process seems to have taken place in the rock of Corstorphine Hill near Edinburgh being a whinstone composed of [crystals] some black, some light coloured but all very distinct and evidently the work of mutual secretion". This provides evidence that field observation in Hall's eyes determined experimental replication.

<sup>123</sup> NLS MS 6330 f. 100.

<sup>124</sup> NLS MS 6331 f. 113.

<sup>125</sup> NLS MS 6331 f. 130.

<sup>126</sup> NLS MS 6331 f. 156.

observed a junction of granite and gneiss: "some small veins seemed to run into the gneiss from the main mass of the granite and there were in the neighbourhood several smaller, very distinct dykes across the shistus, enough to show that the phenomena here are not different from those in Galloway and Lammermuir".<sup>127</sup>

By 22 June, Hall's party had reached the central district of the Puy de Dome. His notes record a certain shock to his sensibilities as his prior knowledge of France did not include the existence of a volcanic region:

The surface of the lava is extremely rough like those of Etna or Vesuvius that have likely flowed through antiquity. This lava reaches beyond all history and tradition as this country was not suspected of being volcanic until the nature of its productions had been examined by naturalists.<sup>128</sup>

The only talk of geological concerns whilst in Paris came toward the end of Hall's visit. During a conversation on the 10 July with M. de la Place, at first over political concerns, Hall noted how conversation turned to geology, noting that matters of theory were emerging in his thought:

I spoke to him of what we were doing in Scotland about the theory of the earth - he said from any astronomical observations that he was convinced the world must once have been in a fluid state by fire tho' he considered Buffon's system as absurd and mathematically false.<sup>129</sup>

Despite these geological encounters and experimental activities, however, political issues continued to be the main and overriding purpose of the visit. Hall's inquisitiveness to furnish himself with facts about post-Revolutionary France were expressed in a letter to his uncle:

(Paris June 12<sup>th</sup> 1791). Dear Uncle, I have received your two letters one of May 16<sup>th</sup>, another of May 25<sup>th</sup>. I was thinking of writing to you before I received them to tell you some things of husbandry I had observed but I have been so closely taken up with attending the national assembly and keeping a journal that I have not made out anything satisfactory.....We set out this day on a little excursion to the country - our object is to see those parts of France that are famous

---

<sup>127</sup> NLS MS 6331 f. 161.

<sup>128</sup> NLS MS 6331 f. 181. Hall made an addition to this entry on August 15<sup>th</sup> 1813, largely theory based it appears to be a statement about volcanic activity as a product not just of contemporary processes but also occurring as a product of the distant past: "these volcanic facts are therefore on a par with our [deluvian] facts in the Alps and in Scotland. Acting upon the surface, just as it now is but at a period beyond the reach even of tradition".

<sup>129</sup> NLS MS 6332.f. 79.

for their retched [sic.] culture in consequence of oppression of every kind and we have a kind of plan of returning some years hence to see the change produced by the revolution. yours J.H.<sup>130</sup>

Hall's travelling companion and brother-in-law, Lord Daer, was extremely politically active, and with experiences of France in the Revolution of 1789 that were vivid. He was an ardent reformer who was a member of the London friends of the people and other political societies.<sup>131</sup>

When Hall returned to Scotland, he continued to take many walks, accompanying James Hutton and John Playfair. After 1810, there is little evidence that Hall was actively engaged in further significant fieldwork, certainly not on the scale of the early European 'Grand Tours'. He instead occupied his time in his foundry, performing experiments, at his home in Dunglass or in the public realm as president of the RSE, in which office he remained until 1820.

Hall's fieldwork demonstrates sound knowledge in contemporary ideas pertaining to earth theory. He used the 'Grand Tour' to test a number of Hutton's ideas after a three-year spell of disagreement in which we may see the beginnings of field observations for theoretical purposes. The tours helped to develop many of his future theoretical ideas but were not tested directly. Hall's observations could be said to have been the last strand of eighteenth-century natural philosophy rather than the beginning of a professional geology. The seeds of change were, however, apparent to a small degree. Travel and personal enlightenment were the most important factors.

It is possible, therefore, to suggest that Hall's fieldwork represented transition from 'observation' for the purposes of personal enlightenment and improvement, to the beginnings of more specialised geological fieldwork motivated solely for 'geological' and theoretical purposes. Hall touched on this change if not adopting it fully. By 1810, however, Huttonians had adopted refutatory field methods fully: a claim true of Sir George Mackenzie in particular.

---

<sup>130</sup> SRO Dunglass Muniments II, 300/50. Also in Eyles (1963), 177. According to Eyles this was the only extant letter written to his uncle whilst he was in Paris.

<sup>131</sup> Eyles (1963), 178. Original reference in Meikle (1912), 106.

## 5.4 Later Huttonian Fieldwork: Sir George Mackenzie, 1810

For those of a Huttonian persuasion, fieldwork as a form of theoretical verification was paramount and may be seen in its most ‘militant’ form through the work of Sir George Mackenzie. For Mackenzie there was no doubt as to the truth-value of Hutton’s theory, and Mackenzie’s trips were undertaken with the intention of gathering evidence to substantiate a view he already held.

In contrast to studies of Jameson and Hall, Mackenzie’s fieldwork has been the most studied aspect of his scientific life. This is due to the importance his Iceland tour (1810) had for Huttonian theory, and because it was a significant part of Icelandic history, being one of the first nineteenth-century rational scientific expeditions to that soil by a foreigner.



Figure 8. Portrait of Sir George Mackenzie [Artist unknown] presumably in private collection. Taken from Kark and Moore, (1986).

The expedition members made geological pursuits as a priority but the tour was also undertaken with a view to observe all aspects of Icelandic culture and landscape. In this sense his journey, although highly important for science, has some connections with the tradition of the ‘Grand Tour’.

### 5.4.1 Iceland as Field Site: Influences and Precursors

Despite his pioneering geological work there, Sir George Mackenzie was by no means the first Edinburgh scholar to visit Iceland. It is to these earlier scholars that Mackenzie may have derived the idea of using Iceland for his Huttonian crusade. Previous voyages by members of the Physical Class of the RSE include Sir Joseph Banks, (1743-1820) in 1772, John Thomas Stanley (1766-1850) in 1789, and William Jackson Hooker (1785-1865) in 1809. All of these men not only distinguished scientists in their own right but were at least aware, if not supporters of, the Huttonian doctrine before Mackenzie. Sir Joseph Black (1728-1799) worked on specimens of water brought back from the Stanley expedition.<sup>132</sup>

Although Banks was never resident in Edinburgh, he frequently corresponded with members of its literati, including John Thomas Stanley and Mackenzie. It is likely that this correspondence contributed to Mackenzie's scientific interests in the country. Agnarsdóttir says that: "Other Englishmen were to follow in his [Banks's] footsteps to Iceland...they all sought his advice and assistance, acknowledging their debt to his pioneering effort".<sup>133</sup>

Another important precursor to Mackenzie was Stanley's 1789 expedition. Not as successful as Banks's, Stanley's residence in Edinburgh made him a closer acquaintance to the young Mackenzie. A wealthy landowner, Stanley was born in 1766 and from an early age was encouraged to travel. He spent several years in France and Italy climbing the volcanoes of Etna and Vesuvius like many learned gentlemen of his time. Stanley, like Banks, developed a geological interest based on experience of volcanic regimes. This may have influenced his decision to visit Iceland. Wawn has suggested that it had an early impact: "Stanley's 1813 journal notes that in May 1787, in the company of his friend Oswald Leycester, he visited Sicily and became fascinated with its volcanoes".<sup>134</sup> During his tour, his scientific interests grew and upon his return he enrolled at Edinburgh University in 1787.

---

<sup>132</sup> Black (1794), 95-126

<sup>133</sup> Agnarsdóttir (1994), 39.

<sup>134</sup> Wawn (1981), 55.



It was during his time in Edinburgh that Stanley became inspired by and acquainted with, Joseph Banks. Stanley undertook his expedition aged twenty-two.<sup>135</sup> Wawn attributes his time in Edinburgh as positively influential:

Edinburgh's contribution to Stanley's readiness for and interest in Iceland cannot be confined to vessels and victuals. To visit and still more to reside in late eighteenth century Edinburgh was to be exposed to the life of a city with an exuberant spring in its cultural stride.<sup>136</sup>

As part of his experience of life at Edinburgh University, Stanley was a keen contributor to the City's social and scientific circles. Stanley's immediate associates were members of the RSE to which he himself was elected Fellow (whilst in Iceland) in 1789.

One such friend was Henry Mackenzie, who was almost certainly his contact to Hutton's circle. Stanley would have been well acquainted with the tenets of Huttonian theory during his stay in Edinburgh but it is his own account of events after his return from Iceland which offer us the best link to the Huttonian circle. He gave an 'Icelandic dinner party' to the Oyster Club in order that members be furnished with his findings and experiences:

My friends of the Oyster club had expressed a wish, I would bring the materials for an Iceland feast back with me, that they might have some idea of the luxuries of the Island...everything was spread out soon after my return in the room next to our club room, but my philosophers left everything almost untouched...the display afforded much amusement and added not a little to the pleasure with which the oysters and apple tarts, the usual club fare, were afterwards assailed. Of the party were amongst others Adam Smith, Dr. Hutton, Dr. Black, Sir James Hall, Henry Mackenzie, Professor Robison and Dugald Stewart. What a constellation! With such guests at a table who would not sit down and try to eat even an Iceland dinner.<sup>137</sup>

The next major expedition from an Edinburgh dweller was Mackenzie's in 1810. His ideas were scientific but much more focussed on using what he had learned from his precursors for the benefit of Huttonian theory.

---

<sup>135</sup> Boucher (1989), viii-ix..

<sup>136</sup> Wawn (1981), 55.

<sup>137</sup> Wawn (1981), 57-57. The original manuscript is in MS Lbs 3888 4to, 436, Landsboksafn Islands (National library of Iceland, Reykjavik). They are annotated diaries written by Stanley in the 1840s based on the records of his companions Wright, Benners, and Baine during the 1789 tour.

### 5.4.2 Theory in the Field: Mackenzie's Expedition (1810)

By 1810, much geological discourse in the public domain was linked to matters of theory. As an outspoken member of this 'culture' of earth theory, Mackenzie had not only decided on Iceland because of his precursor's advice but because it offered the best opportunity to collate data that would add credence to Hutton's theory. His motives were clear when, in 1826, he told the University Commissioners:

[The collection] did illustrate the Huttonian theory. And it was with the view to ascertain the origin of the trap formation of rocks, and which was disputed between the Huttonians and Wernerians, that I went to explore Iceland.<sup>138</sup>

The Iceland expedition set sail from Leith on 18 April 1810, returning in September that year. From the outset, Mackenzie noticed that Iceland was almost entirely volcanic. He later noted: "the instance of tuffa expected I saw no trace of stratification in Iceland all the rocks having been subjected to a state of perfect fusion".<sup>139</sup> Perhaps the most conclusive evidence against Wernerian theory was the discovery of obsidian and pumice under such conditions as precluded any but an igneous mode of formation:

So intimately have Werner and his pupils interwoven the minerals in question with other rocks that if their origin shall be proved in any one instance to be volcanic, the whole of Werner's theory, as far, at least as it concerns unstratified floetz rocks, will be unhinged. The importance of a strict examination of them becomes therefore very great both to the supporters and the antagonists of the Wernerian geognosy.<sup>140</sup>

In the same expedition, Mackenzie laid the foundations for a geological knowledge of Iceland and collected evidence that rendered the Wernerian theory almost untenable.<sup>141</sup> His greatest asset in this was the specimens he collected and brought back.

### 5.4.3 'Hard' Evidence: The Expedition Rock Specimens

Jameson and Hall's notebooks contain little discussion of specimen collecting despite it taking place for private collections rather than use as corroboratory evidence: Jameson

---

<sup>138</sup> *Evidence* 1, 620.

<sup>139</sup> Mackenzie (1811), 361. Peacock (1925-6), 194-5.

<sup>140</sup> Mackenzie (1811), 366.

<sup>141</sup> Peacock (1925-6), 196.

for his museum.<sup>142</sup> Mackenzie's success – because his journey was solely for the purpose of gathering evidence – hinged on the recovery of samples for that purpose. Apart from the observations Mackenzie made of the rocks *in situ*, the team expedition collected and carefully labelled over three hundred specimens, at the time, the most detailed geological information for Iceland. The specimens had a 'turbulent' homecoming given Robert Jameson's refusal to display them to the public in his museum.<sup>143</sup>

For over 100 years, this rich source of information excited only a few people interested in Icelandic petrography and it was not until 1925 that a full petrographical analysis of them took place.<sup>144</sup> Mackenzie's evidence in favour of the Huttonian theory did not come from microscope petrography but was inferred from interpretation in hand specimen. Although hand specimens provided palpable proof of volcanic origin, they clearly restricted the amount of detail that could be demonstrated.

Mackenzie's primary goal was to find specimens that would render the Wernerian theory untenable. He was particularly keen to look for specimens that provided such proofs through surface features:

I allude to obsidian and pumice...having been discovered in connection with rocks whose origin was not so apparent, they were likely to upset the great system that had been constructed by Werner who had no other resource but to deny altogether their igneous origin and to assert that they were of aqueous formation. Obsidian and pumice having been found connected with rocks, supposed by Werner to have been produced by water, is the only proof he has adduced to render of no avail the testimony of many philosophers, who have asserted from their own observations that these substances are distinctly amongst the productions of volcanoes...if their origin [rocks] shall be proved in any one instance to be volcanic the whole of Werner's theory as far at least as it concerns unstratified floetz rocks will be unhinged.<sup>145</sup>

As already stated, the search for obsidian was of paramount importance. Wernerians alluded to an aqueous explanation of obsidian on the grounds of its connection with

---

<sup>142</sup> It is assumed that specimens were collected although the notebooks and diaries do not mention it. Hall would have experimented on numerous samples (although many were donations) and Jameson would have collected for his museum mineral cabinet.

<sup>143</sup> Robert Jameson lost many specimens. The Royal Society of Edinburgh only ever had a catalogue of the rocks in its possession (Waterston, 1997, 157-8). They are now in the possession of the Hunterian Museum, Glasgow, and were given over in 1910. Accompanying the stored specimens are detailed catalogues of the localities and descriptions compiled in the appendix to Mackenzie's (1811) publication and in Peacock (1925-6).

<sup>144</sup> Peacock (1925), 271-333.

<sup>145</sup> Mackenzie (1811), 366.

other substances. According to Mackenzie, if those other substances could be proved volcanic in origin, the Wernerian argument would falter.

Mackenzie found this evidence on his third excursion at the site known as Torfajökull.<sup>146</sup> Located twenty kilometres east of Mt. Hekla, the obsidian and pumice proved to be most important for his theoretical reasoning. Mackenzie did not hide his delight at having found the specimens:

As if from a surface of glass, [it] delighted us with instantaneous conviction that we had attained one of the principal objects connected with the plan of our expedition to Iceland... Our discovery of Obsidian afforded us very great pleasure, which can only be understood by zealous geologists; and we traversed an immense and rugged mass of that curious substance with a high degree of satisfaction.<sup>147</sup>

The rocks in question were labelled according to area collected and type by the Hunterian Museum, Glasgow in 1910 as R368-R375.<sup>148</sup> Why were they so significant? Mackenzie had found elements of other volcanic rocks that had embedded themselves within the obsidian. Photographs R368 and R369 provide the answer. They are black obsidians that contain larger white feldspar phenocrysts up to 4-5mm in size. The groundmass of the obsidian is a perfect colourless glass that indicates a rapid cooling rate from the melt. The larger feldspar crystals indicate slower cooling which render them second generation but volcanic in origin. Included in the glass the larger crystals were second generation (produced by re-heating of the rock and then slower cooling the next time) and so proved to be formed by heat processes alone, rendered the explanation from aqueous solution untenable.

---

<sup>146</sup> The most important pumice and obsidian specimens for providing evidence in favour of the Huttonian theory came from the *Torfajökull* and *Dómadalshraun* areas in the Hekla region, South-West Iceland.

<sup>147</sup> Mackenzie (1811), 242-243. Peacock (1925), 300.

<sup>148</sup> Peacock's analysis defines the specimens as 'Acid Lavas from the post glacial formation'. The photographs I have taken rely on this mode of identification. For Mackenzie's cabinet definition, see App.1, section C no, 20.

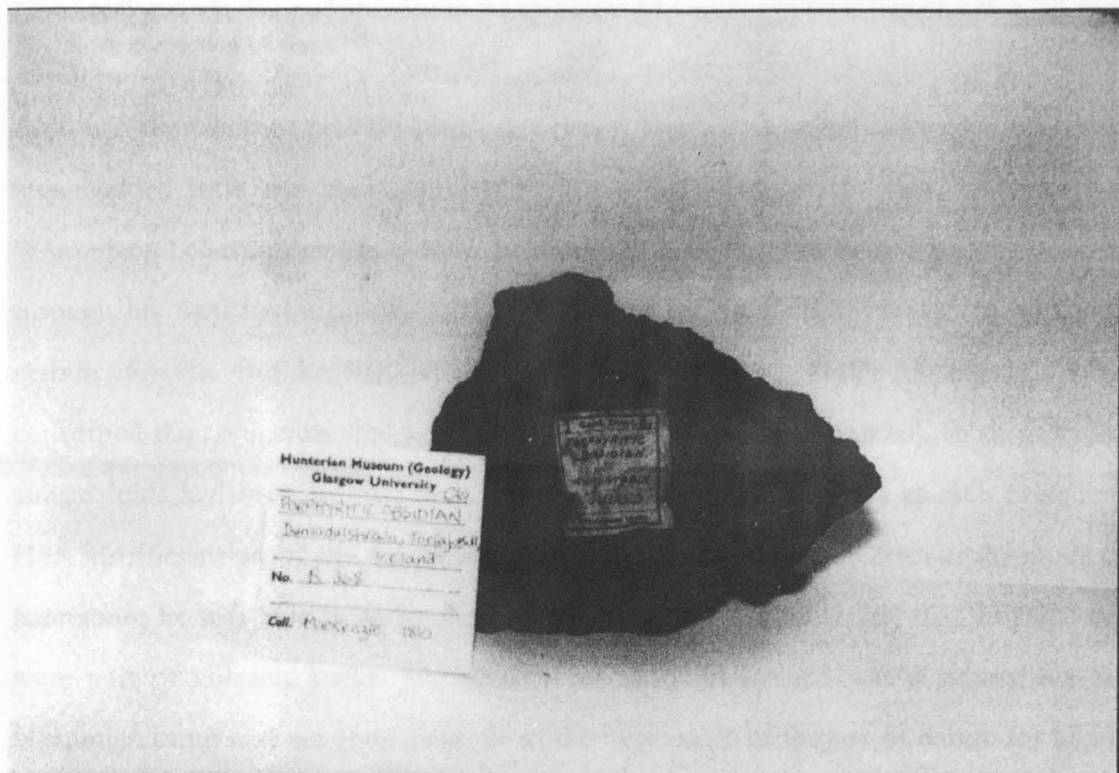


Figure 9. Photograph of the Mackenzie collection, R368, taken by the author in 1996. Printed by kind permission of the Hunterian Museum, Glasgow.

### 5.5 Conclusion

In specimens R374 and R375, the basalt containing the crystals was caught up in an obsidian flow as a melt. This liquid flow then cooled when it was dripping from the roof of a cavity producing the stalactitic effect. Mackenzie described specimen R375 in his 1811 catalogue as:

A remarkable and beautiful specimen the last of the series of a stream of obsidian. It is a mass of slag in a cavity in which some fusible matter has been included and reduced to the state of glass. The cavity is lined by it in stalactitic masses and some of the matter has been drawn out to the fineness of hair. No operation of water could possibly produce these appearances.<sup>149</sup>

This effect was the product of melt processes alone. Mackenzie had found specimens that conclusively demonstrated that they could not have been formed via the tenets of Werner's theory.<sup>150</sup> Mackenzie's fieldwork had been successful:

There is no way left for Werner and his followers to evade the striking application of the facts I have ascribed to the Huttonian theory, but to deny their existence. I can hardly believe that any

<sup>149</sup> This corresponds to photographs R368-375.

<sup>150</sup> For a full petrological analysis of these specimens, see Appendix 2.

geologist who has paid attention to the specimens I have brought from Iceland, will shrink from the conviction of sense.<sup>151</sup>

Although they did not provide conclusive proof, Mackenzie attempted to use numerous inter-bedded tuffs and conglomerates to prove that amygdaloids were, in fact, lavas. Wernerians believed amygdaloids to be aqueous in origin. Mackenzie had to concede through his own investigations that calcite could be dissolved by water charged with carbon dioxide. But he had also learned from Sir James Hall's experiments (that confirmed the conjecture that high-pressure calcite could be restrained), to suggest that amygdaloids had been formed from sea floor eruptions taking place at such pressures. Here insufficient proof was found, and, although Mackenzie was in error at the mode of formation, he was able to show through the tuffs and agglomerates, that amygdaloids were part of volcanic rocks. Mackenzie's fieldwork in Iceland was a victory for the Huttonian camp and is a good example of the beginnings of the use of nature for highly motivated and specialised theory-driven exercises.<sup>152</sup>

## 5.5 Conclusion

In this chapter I have shed some new light on the nature of changes in fieldwork practice. For the purposes of this study, I have shown that by the beginning of the nineteenth-century, Huttonians adopted work in the field for refutatory and corroboratory theoretical purposes. Jameson was primarily a inductivist who gathered evidence, incorporating theoretical discourse into his fieldwork as a form of 'resistance' to claims made against Wernerian doctrine.

In summary, Edinburgh geologists used the field in a variety of ways for a variety of reasons, the complexity of which would require a formidable research task to explore fully. What can at least be inferred here, however, is that fieldwork can be viewed as a complex process with no clear-cut notion of change or discontinuity. A variety of methods was employed simultaneously. What is clear is that a move away from uses of

---

<sup>151</sup> Mackenzie (1811), 383.

the field for personal improvement through the interpretation of nature for verificatory means took place, but did so, as a gradual process, involving the co-existence of elements of Grand Tour operations with more specialised corroboratory techniques. With Hall, Mackenzie and Jameson, one method dominated with each but was never fully replaced by the other.

A definite distinction can be drawn, however, between Jameson and Mackenzie as individuals who simultaneously extolled the merits of observation in the field for scientific purposes but with contrasting methodologies and motives. Jameson did use the field for verificatory means, but, in contrast to Mackenzie his theoretical sensibilities were less to the fore. usage is small. Jameson used the field to bolster theoretical ideas but primarily used inductive methods of evidence gathering in conjunction with the more mineralogical aspects of fieldwork through Baconian descriptions of minor features.

---

<sup>152</sup> The impact of the Iceland findings and Mackenzie's assistants, Henry Holland and Richard Bright is discussed in chapter seven. This chapter is concerned only with the methodological nature of his fieldwork.

## EXPERIMENTATION: THE USE OF CHEMISTRY

### 6.1 Introduction

In this chapter, I highlight the principal differences between Jameson and the Huttonians through their use of chemistry in order to answer questions to do with the use by Huttonians, like Hall and Hope, of experimental procedures as a corroboratory tool for the furtherance and development of Huttonian theory. By comparing Sir James Hall's use of this method with Robert Jameson's rejection of chemistry as a viable form of natural knowledge investigation, I shall strengthen the argument presented thus far that an understanding of geological debate in early nineteenth-century Edinburgh requires rethinking on the grounds of intellectual context and contrasting scientific methods.

Developments in Enlightenment chemistry have been the topic of extensive historical examination but not as they relate to geology.<sup>1</sup> Chemistry also has significance for understanding 'place-centred' natural knowledge as it was generally an accepted method of scientific investigation before the nineteenth-century institutionalisation of chemical study, experiments were often conducted in privately-owned laboratories without demonstration and the results only exposed through publications. I shall first attempt to answer why and how the science of chemistry's accepted public standing

---

<sup>1</sup> Highlights are Shapin and Schaffer (1985); Donovan (1975); and Gooding, (eds.), (1989). Similarly, many theoretical studies exist in the sociology of science that concentrate on the laboratory as a place for the construction of scientific knowledge (mostly in a twentieth-century context). The best known recent studies are Gooding (1990), and Latour and Woolgar (1979).



gave rise to its use for obviating difficulties in Hutton's theory: particularly Sir James Hall's experiments. I shall first put forward reasons why chemistry was considered so important to early Edinburgh geologists and establish why close links existed between these disciplines.

## 6.2 Experimental Geology in Scotland: Origins

Experimental geology at the beginning of the nineteenth century rose out of chemistry's public profile and intellectual advances made during the Enlightenment period.<sup>2</sup> According, however, to the very loose definition of what a 'geological' experiment was, many examples exist of procedures being administered to phenomena relating to the 'Earth' much earlier: as far as the sixteenth century.<sup>3</sup> Although chemistry's concepts were well defined for the late eighteenth-century scholar, what constituted a 'geological' experiment remained arbitrary. Rudler noted:

If, for instance the scientist is anxious to ascertain the character of the strata hidden beneath his feet, and to drill and bore the solid earth, does he not become in a limited sense an experimentalist? A moments' reflection however will show that the geologist who makes a trial boring or undertakes an experimental sinking, is no more entitled to rank as an experimentalist than if by means of his hammer he simply struck a chip from a rock in order to examine the character of its fracture.<sup>4</sup>

---

<sup>2</sup> Hankins (1985), 81. Hankins argues that scientists and historians alike have concurred in identifying the Enlightenment period as the time when chemistry enjoyed its 'revolution'. Boerhaave and Stahl in Europe, Joseph Black and William Cullen in Britain are amongst the best known.

<sup>3</sup> Historical analysts have discovered largely unheralded experiments on earth related topics. Steven Yearley (1984), 41, has shown that, in Europe, experiments were carried out by some of the best-known scholars of their time. Spallanzani (1636) carried out experiments on lava and similar rocks with volcanic activity; Saussure's well known *Voyages dans les alpes*, (1779), contains records of his experiments on granite; and Faujas de St. Fond (1788), carried out analyses of lavas. On the theme of crystallisation, several analysts in France (including Darcet and Pott) undertook heating, refrigeration and annealing trials on porcelain-type materials and glasses. In Britain, Robert Hooke worked (in 1665) on earthquake simulation; Catcott (1761), carried out experiments on denudation; and Plattes worked on the chemical formation of the substances of the Earth's surface. Keir and Priestley undertook experiments on volcanic material. Joseph Black may also be considered an experimental natural philosopher that worked with geological material. Dennis Dean also cites many examples of experiments that could loosely be classed as 'geological'. These include several eighteenth-century experimenters concerned with the nature of crystallisation. For instance, René de Réaumur's experiments with kaolin; Joseph Black and the fusability of basalt; J.H Pott on the fusion of minerals (1746); and Jean Darcet in the 1760s. Dean also mentions others who were actively engaged in applying chemical techniques to geological problems. Desmarest (1774) attempted to melt specimens of granite.

<sup>4</sup> Rudler (1889), 69.

In trying to define the concept Rudler suggested that a geologist became an experimentalist whenever he introduced artificial conditions to assist in the observation of nature.

The strongest defining character of an experimental geologist in the eighteenth century was, however, through the establishment of links with chemistry.<sup>5</sup> The true success of the science in the period was a product of the rationalisation of its qualities and operations. In the eighteenth century, chemistry and experimental physics became closely linked owing, chiefly, to a shared interest in the Aristotelian elements: earth, water, air and fire. Of these elements, the two most important for the chemical revolution were air and fire, both of which were believed to be primitive and elemental.<sup>6</sup> This close association remained in place throughout the eighteenth century but the gradual rise of industrial chemistry for economic and utilitarian purposes and its widening of appeal by the discoveries and popularisation in teaching by William Cullen and Joseph Black in particular, saw further growth of its interest and practice.<sup>7</sup> In this context, laboratory experiments were used to construct causal accounts of the Earth's past.<sup>8</sup>

As well as verificatory experiments that purported to obviate difficulties in theoretical accounts of the earth's formation, experiments were also linked to geology because each discipline shared common interests in, and proved useful for, economic and utilitarian purposes in mining, mineralogy and agriculture.<sup>9</sup> Links between utilitarian uses for chemistry, particularly through advances in German mining, brought chemistry

---

<sup>5</sup> A firmly established link between chemistry and the earth arose out of the 'phlogiston' theory first elaborated by Georg Stahl (1660-1734) the founder of the doctrine of essential chemical principles. One unanswerable question remained in relation to phlogiston. Its proponents could not explain why turning a calx (which contained no phlogiston) into a metal (with an air that had absorbed and been poisoned by a phlogiston) produced a net loss in overall weight. How could it be possible for phlogiston to weigh less than nothing? The problem was overcome by Lavoisier whose work not only answered key questions in combustion but who also imparted a whole set of revolutionary new ideas in eighteenth-century chemistry.

<sup>6</sup> Hankins (1985), 85.

<sup>7</sup> Laudan (1987), 138. Rachel Laudan has argued that it is through the eighteenth-century tradition in chemical mineralogy and cosmogony that Werner's earth theory was able to emerge.

<sup>8</sup> Laudan (1987), 47.

<sup>9</sup> Gould (1987) makes the point that James Hutton emphasises soil in his 'elements of Agriculture because it represents the final and the beginning form of a mechanistic earth system. See also Home F (1767) *Principles of Agriculture*.

and geology closer together in late eighteenth-century Europe as well as Scotland. Laudan has argued that it was chemical analysis (in what she called the ‘wet way’)<sup>10</sup> that formed the empirical basis of geology by the mid-eighteenth century. Chemist-mineralogists assumed that the process by which solid earth separated from the waters of the ocean were analogous to laboratory reactions.<sup>11</sup> By using this method of analogy, laboratory experiments could be used to link causes with effects. This came about with the development of chemical cosmogonies in eighteenth-century Europe.

Chemical analysis as an inductive process was also very strongly linked to advances in mineralogy. Richard Kirwan reflected in the second edition of his *Elements* (1794) that his aspirations for a “scientific” mineralogy based on this ‘chemical analysis’ had been achieved.<sup>12</sup> William Henry in his *Elements of experimental chemistry* (1810) agreed with Kirwan. Henry argued that through the application of chemical analysis “mineralogy has been advanced from a confused assemblage of its objects, to the dignity of a well methodised and scientific system”.<sup>13</sup>

After 1780, two clear alternatives to the use of chemical analysis as a basis for mineral identification emerged. They were Werner’s system of identifying minerals through external characteristics,<sup>14</sup> and the French program of crystallography adopted by Jean Baptiste Rome de l’Isle (1736-1790) and Rene Just Haüy (1743-1822).<sup>15</sup> In Britain, both systems had their advocates in the first two decades of the nineteenth century.<sup>16</sup> Nevertheless, experimental geology in the form that it took at the beginning

---

<sup>10</sup> Laudan (1987), 66. A term used to describe the causal relationship between earth and water. For example, the laboratory condition of growing crystals in water through the method of analogy.

<sup>11</sup> Laudan (1987), 66.

<sup>12</sup> Laudan (1987), 272.

<sup>13</sup> Henry (1826), *The Elements of Experimental chemistry*, 10<sup>th</sup> ed. Vol. I. p. xiv.

<sup>14</sup> Laudan (1987), 273. Werner’s system comprised a method for identifying mineral samples from their sensory qualities. The relevant characteristics included smell, taste, touch and a whole range of visual properties such as colour, crystalline form and transparency. Despite this, the documents do show that Werner had respect for chemical methods in mineralogy.

<sup>15</sup> Golinski (1992), 272-3.

<sup>16</sup> Laudan (1987), 274. A number of British mineralogists such as Thomas Thomson, Robert Jameson, and William Phillips also saw Werner’s system as entirely compatible with the use of inductive chemical analysis. The British Wernerians extended their master’s important work on the mapping of rocks through local field practices. There was debate between these two schools that also touched on the role of chemical analysis, Richard Chenevix being Werner’s principal opponent.

of the nineteenth century evolved neither alone out of eighteenth-century chemistry nor just from the uses of chemical analysis in mineralogy.

The public profile of chemistry and its implications for political economy were also paramount. In providing endorsement from the academic establishment, chemistry, and, therefore, experimental geology could enjoy an enhanced 'public' reputation. Instituted as chemistry was in Enlightenment Scotland by William Cullen and Joseph Black, Golinski argues that it became a socially-recognisable enterprise by raising its profile as a separate discipline and a 'public' science.<sup>17</sup> Because of this, chemistry was able to become a recognisable and publicly-acceptable method of natural knowledge production.

Golinski also argues that new discoveries placed unprecedented powers in the hands of the chemist and promised revelations of the innermost secrets of matter. It was mainly to chemistry, therefore, that hopes for further scientific progress turned in the first two decades of the nineteenth century.<sup>18</sup> Public endorsement may explain why it was considered by Sir James Hall to be a legitimate form of knowledge production for the purposes of verifying aspects of Hutton's theory.<sup>19</sup> By 1799 the institutionalisation of chemistry had been firmly established at Edinburgh University. Despite this, however, there were no public practical demonstrations at the University in Edinburgh until Thomas Hope introduced them in 1823. Chemistry teaching by means of lectures continued: a deficiency that was exploited by private teachers.

Despite these changes, Jameson remained opposed to the merits of chemistry, preferring instead the descriptive methods of the natural historian and the 'natural

---

<sup>17</sup> Golinski (1992), 11. Arthur Donovan and John Christie have also discussed the public reception of chemistry in Scotland. They place William Cullen and Joseph Black's discoveries in their social context. The reception of 'new' chemistry in Scotland has been discussed specifically by Perrin, Donovan and Christie. Perrin specifically addresses the question of the reception of the new chemistry in Scotland: Perrin (1982), 141-176. Perrin's study places great emphasis on the institutional and personal factors that linked French and Scottish chemists, particularly James Hall who is discussed in more detail later in this chapter. See also Donovan (1979), 237-249 and Christie (1979).

<sup>18</sup> Golinski (1992), 236.

<sup>19</sup> Golinski (1992), 237. In the previous sections, I have demonstrated why the public imagination would have been drawn to the operations of the chemist. Priestley's discoveries and their exhibition in public lectures had made known the dramatic properties of the new airs. Lavoisier's chemical revolution had shown how gases were intimately involved in the most common and diverse chemical processes. Cullen

history method'. James Headrick in the *Edinburgh Review* made an argument about Jameson's work as not deserving merit owing to its failure to address chemical concerns:

Of the extensive science of chemistry, mineralogy forms a small department, and, though all to indebted to chemistry for its existence as a science, has all too frequently attempted to affect a disunion.....He [Jameson] tells us roundly in page 50. Of the introduction that 'chemical nomenclature' should not be admitted in mineralogy; and therefore he regales the intellectual palate of his readers with 'hair salt' and 'rock butter'. Nor is his hostility to chemistry confined to so minute a consideration as the names of substances; he would willingly banish its agency entirely; upon all occasions he yields to its dictates; and whenever the ideal distinctions of the system he embraces seems to be in contradiction, he boldly renounces its authority.<sup>20</sup>

The argument of 'intellectual context' is further strengthened by this notion as, in complete contrast, Huttonian opposition came from the adoption and use of chemical techniques which relied on analogy, hypothesis testing, and in being refutatory in nature. Hope instituted these methods of enquiry in the university setting and was the first to introduce practical demonstrations in chemistry.

### 6.3 Huttonian Chemists

As a publicly endorsed method wholly compatible with theory and hypothesis, it is no surprise that practical analytical chemistry appealed to Huttonians. Perhaps the two most ardent supporters for Huttonian theory were Thomas Hope and Sir James Hall. Hope may be seen as chemistry's populariser in aiding the institutional acceptance of Hutton's theory and as professor of chemistry in the University of Edinburgh. Hall was chemistry's experimenter, and, despite not holding a university post, he undertook experiments over a thirty-five year period specifically to obviate difficulties in Hutton's theory.

---

and Black had broadened the appeal and uses of chemistry to many theoretical and empirical branches of endeavour.

<sup>20</sup> *Ed Rev*, Vol. 5, No. 9. (1804), 75.



Figure 10. Portrait of Sir James Hall (Pg 2990) By Angelica Kauffman. Printed by Permission of the Scottish National portrait Gallery.

### 6.3.1 Popularising Chemistry: Thomas Hope (1766-1844)

Chemistry, as others have shown, was fully instituted by the time Hope took over the chair in 1799. Thomas Charles Hope, a protégé of Joseph Black, became one of the most successful chemistry lecturers of his time and as professor in the first three decades of the nineteenth century, introduced many changes of his own. Morrell has

highlighted Hope's achievements in chemistry.<sup>21</sup> Given the links between chemistry and geology in the period, Hope's actions are of primary consideration in relation to Jameson's. Although he was not known for geological teaching *per se*, he was a frequent contributor to debate on geological issues within the university. As Morrell points out "There is no doubt that Hope was one of the most popular and successful chemistry lecturers of his time".<sup>22</sup> Hope was able to command and attract large audiences and on eight occasions had more than five hundred people sign for his class.<sup>23</sup> Hope made chemistry popular. John Leslie said of Hope after a decline in his own class numbers, "[with] the taste of hard study evidently on the decline the glare of chemistry obscures everything else".<sup>24</sup>

Yet many aspects of Hope's work require closer study owing especially to his geological interests.<sup>25</sup> Hope freely espoused Lavoisier's ideas and maintained a sustained interest in the chemical bases to the Huttonian-Wernerian dispute.<sup>26</sup> Unlike Hall, who held no university position, Hope provided opposition to Robert Jameson on geological issues from within the walls of the university after the death of John Playfair in 1819, particularly with regard to upholding verificatory over Baconian methods of investigation.<sup>27</sup>

Once John Playfair had died Hope was the only university professor who could counter Jameson and represent the school of Hutton – a school which had its origins in Edinburgh. Even before Playfair died Hope was in a more advantageous position because geological matters could more easily be discussed by the chemistry professor than the holder of the natural philosophy chair.<sup>28</sup>

Hope's methods contrasted markedly with Jameson's. Hope performed an important function in his lectures on the relevance of chemistry to the animal, vegetable and

---

<sup>21</sup> Morrell (1969).

<sup>22</sup> Morrell (1969).

<sup>23</sup> *Evidence 1*, (1826).

<sup>24</sup> Morrell (1969), 66-80.

<sup>25</sup> Owing to word restrictions a thorough examination cannot be conducted here except to introduce Hope in the context of Hall's work, as the embodiment of experiment in the 'establishment'. Hall never held a university of any professional post and therefore the reputation or recognition of his work to the public was dependent upon how popular it was made by professors like Thomas Hope.

<sup>26</sup> Morrell (1969), 67.

<sup>27</sup> Chitnis (1968), 187.

<sup>28</sup> Chitnis (1968), 187.

mineral kingdoms that ran in contrast to Jameson's Wernerian principles of 'sensory qualities' and descriptive phenomena.

Secord notes that Hope opposed Wernerian views, and included lectures linked to mineralogical topics. The notes of a student revealed that in a lecture on 'Ferrigenous metals', Hope discussed the stratified silica-bearing rocks and their formation: "the speculations regarding the causes of stratification have been called theories of the earth...Dr Hope thinks that the Huttonian better accounts for the appearance of nature than the Wernerian theory".<sup>29</sup>

Secord also suggests that in a lecture on compound rocks Hope showed that the experiments of the Huttonian Sir James Hall, "proved that lava assumes a stony appearance" when cooled slowly, but if, "it be allowed to cool quickly", it has a vitreous appearance. Hope, in contrast to Jameson, presented science as an enquiry into causal processes: "the chemist" he announced, is not content with ascertaining the changes of bodies, but he also endeavours to explain the reasons of those changes, and the results arising from them". Thus, for Hope, geology did not advance through ordering strata or collecting minerals (Jameson), but by understanding processes.<sup>30</sup>

Hope's style also contrasted markedly with Jameson's. He was not conservative in manner and if someone did not agree with him on geological issues, his flamboyance that won him many friends in lectures, could turn to scorn in his personal attacks. When he attended the natural history lectures of Dr Edward Clarke in Cambridge, a close friend of Jameson and Fellow of the Wernerian society, Clarke wrote to Jameson to complain of Hope's conduct:

I am much obliged to you for your kind letter. I cannot say that I have been engaged in a controversy with Dr Hope but a covert attack was made upon me by that Gentleman, in his lecture room; which so excited the indignation of his audience that more than one letter was sent to me to inform me of unhandsome conduct. I'm sure that you will readily allow no advantage to science can accrue from a practice so illiberal, as that of the professor of one university, culminating those of another university. As we have never mentioned Dr Hope's name, nor the names of any other professors in Scotland, but with respect and honourable encomium, we could not at first believe that Dr H. had really been guilty of such meanness. Professor Leslie therefore, delivered to him a letter, from me demanding an explanation; when, instead of a plain answer aye or no, he sent to me 4 folio sheets filled with the most wretched sophistry; respecting which but

---

<sup>29</sup> Secord (1991a), 139.

<sup>30</sup> Secord (1991a), 141.



one opinion is entertained; as of the whole transaction. I cannot therefore condescend to engage in any controversy with a person who has acted in such a manner so unworthy of his station. If he had fairly and openly addressed me, I should have been proud to meet the questions which he might have proposed: having stated nothing, either publicly or privately, which I am not prepared to maintain and to defend.<sup>31</sup>

Jameson, Hope, Playfair and Leslie all attended the University of Edinburgh as students<sup>32</sup> benefiting from an enthusiastic professor, who gave a detailed course of unparalleled facilities for the first time. This they all passed on to their own students but with, however, conflicting opinions on geology and with differing personalities and methods. It is more difficult to ascertain how much they influenced students or even discussed geological issues from within the lecture hall.

What is clear is that Jameson the teacher of geology met with opposition for his adherence to Wernerianism. Since Jameson was official tutor, it was to his work that studies of the effectiveness of geology teaching must turn. These conditions contributed heavily to the relative success of Sir James Hall's geological experiments and their recognition as viable forms of knowledge replication by the *Edinburgh Review*.<sup>33</sup> The greatest chemical 'accolade' for Hutton came from outside the university, in work conducted by Sir James Hall. It is to Hall I shall first turn.

## 6.4 Sir James Hall: Experiments and Huttonian Theory

I not only wish to show why Sir James Hall's experiments were greeted with a certain degree of success in their own right but also, in introducing new evidence, to show why it was so significant as a 'method' of natural knowledge production in association with Huttonianism. A new examination of Hall's experimental life further enhances the argument of 'intellectual context' as being crucial to the understanding of the nature of geological debate. Why were the techniques of the chemist adopted by Huttonians for Huttonian purposes and not by Jameson? What is the significance of this for

---

<sup>31</sup> EUSC Gen. 1999. (Pollock Morris Collection) Edward Clarke to Robert Jameson Cambridge May 21 1817.

<sup>32</sup> In Chitnis (1968), 207.

<sup>33</sup> For more on this review see Chapter Seven.

understanding wider public attitudes to theoretical natural knowledge over and above Baconian principles?

In the last years of his life, James Hall suffered from frequent bouts of ill health, which often left him immobile. His wife, Lady Helen, so much disturbed by his condition, decided to move him away from their estate at Dunglass back to Edinburgh where he could receive full time care:

Nothing can be easier yet when he has had an attack of epilepsy (which is sure to be every four to five weeks, the doctors don't like him to take carriage...Sir James had more than three weeks of great suffering ...the attack is what the medical men call gangrene in the foot, by no means uncommon to old people and the foot is in a sad state with swelling and inflammation. With a succession of abscesses he has more days in which his moans indicate the pain he suffers. He is entirely confined to bed. The only change is being lifted by men and laid on a couch which being wheeled from the dining room where his bed is into the back parlour he gets a little change of air...<sup>34</sup>

Despite these ailments he would still enjoy working and conversing with colleagues on scientific and other matters:

He [Sir James] is therefore about to take a house in Edinburgh for the winter half year which is in every way well as he will be near medical advice but enjoy society of pleasant acquaintance which he likes and should think he could ill do without that support to his spirits.<sup>35</sup>

Hall remained a very dedicated and distinguished independently wealthy scholar, in the guise of a 'landed amateur'. Unlike Jameson and Hope, Hall never held a university post. Yet for very different reasons to Jameson the results obtained, and the reactions toward Hall's publications did not receive a great deal of public attention or wealth of comment from contemporaries although they assisted in providing verificationary proof in favour of Hutton's theory.

To highlight the paradox that chemistry was publicly accepted but not publicly demonstrated in the university, I shall also show the importance of the locations in which he worked, with whom and in what conditions. Further, the public reaction to his work has also been largely omitted.

---

<sup>34</sup> NLS MS 14196 f. 131. Lady Helen Hall to Mrs Hunter, Dunglass Estate, 8 Nov, 1829.

<sup>35</sup> NLS MS 14196 f. 177. Letter of Lady Helen Hall, to Mrs Hunter, Dunglass Estate, 14 Dec, 1831.



*Wonderfully like Sir James Hall the great geologist  
in fine body.*

SIR JAMES HALL, Bt, F.R.S. (1701-1832)

Pen and ink sketch in the Nasmyth Collection of Prints and Drawings (89)

Figure, 11. Sir James Hall sketched as an old man. Part of the collection of Nasmyth prints and drawings, NLS MS 3242. Printed by permission of National Library of Scotland.

The chief mode of concentration in the literature has been on the experiments themselves and their relation to Hutton's theory. I shall demonstrate that even this has not been fully written about or understood properly. Hall's local scientific background was not as opposed to experiment as is often thought. In understanding his position,

one must place him within the context of his social status as a Baronet and a leading member of Edinburgh's literati.<sup>36</sup>

Hall had a reputation as a chemist but his 'geological' status has, in recent times, been the subject of conflicting opinion. Much of the early secondary literature expounds his experimental work as revolutionary, often being labelled the 'pioneer' or 'father of experimental Geology'.<sup>37</sup> In contrast, Steven Yearley and Rachel Laudan portray Hall as a traditionalist, who simply used eighteenth-century experimental techniques in mineralogy. Yearley suggested that his methods of enquiry labelled him in the same way I showed his early field enquiry as: "marking the continuation or even the demise of an old tradition rather than the inauguration of a new one".<sup>38</sup>

Hall was not a traditionalist in respect to his adoption of Lavoisierian chemistry. He was the first to introduce its concepts to the RSE in 1791. Hutton was more 'a traditionalist' by having a sceptical view of the 'new' chemistry.<sup>39</sup> Despite this opposition, Hall adopted the ideas and procedures and in so doing revived many of the tenets of chemistry as it had developed in late eighteenth-century Europe for this purpose.<sup>40</sup> Despite this Hall converted in 1791 whilst in Paris so making Hall's acquaintances with Joseph Black and Thomas Hope strong. After Hutton's death they were not only aware of Hall's experiments but often gave him advice on certain aspects of the work. When conducting his early experiments on Whinstone, Hall noted:

One day I made several trials in the oven. I spoke of this to Dr Black who wished me to make him a little cap of porcelain. Likewise Dr Hope had a glass globe ready for the purpose, which were cut into two halves.<sup>41</sup>

When the experiments were not being carried out Hall still educated himself in chemistry, as his diaries show: "I have written nothing in this book since 31 January. I

---

<sup>36</sup> Brannigan (1981) puts forward a sociological perspective on the notion of scientific discovery, suggesting that it is only in the social power of other's recognition that the status of discovery can exist. It is perhaps befitting that Hall's status as the founder of experimental geology might best be explained in this light.

<sup>37</sup> Flett (1921) was the earliest author to use this phrase. It has been repeated by Gillispie (1959) and questioned by Yearley (1984).

<sup>38</sup> Laudan (1985), 233, fn. 3.

<sup>39</sup> Hutton (1795), 251.

<sup>40</sup> Laudan (1987), 133.

have however been closely employed at chemistry ever since having taken my notes in my pocket book or on loose sheets of paper".<sup>42</sup>

Experimentation as a problem-solving process was widely practised throughout the eighteenth century. It is clear that even contemporary historiographers in some respects saw Hall as 'pioneer'. Hall is best known for being one of the first 'Huttonians' to conduct experiments that purported to obviate difficulties in certain aspects of the theory. As a corroboratory tool Hall dedicated a near lifetime of work toward helping Hutton's theory gain greater credence and this should be separated from the mere analytic trials that preceded him. Unlike other people who had experimented on geological topics, Hall's experiments were far from a series of empirical tests on the effects of heat. They symbolised a deep-rooted philosophical tradition of the use of verificatory methods for the advancement of theoretical knowledge and were also a reflection of changing attitudes toward the use and merit of theory in natural knowledge production.

Hall's encounters with chemical experiment came at an early age. Perhaps the most influential was a series of meetings he had whilst abroad in Paris in 1791 with Lavoisier, Seguin and Dolemiu. Whilst in Paris he engaged in a series of discussions and practical demonstrations and, despite being only briefly there, made sure that he attended them as often as he could:

Monday 16<sup>th</sup> [May], Dined at M Lavoisiers....M Seguin - he showed us Lavoisier's machines - one for forming charcoal and ore for oil and air pumps.....went with Seguin to Mr Charles's he showed us the machine in which he had repeated [Van Freisturks?] experiment. It requires the patience of a Dutch man, the glasses break so often.<sup>43</sup>

Most of the experiments conducted included the action of a powerful heat force in the form of a furnace: apparatus that became the chief agent in the course of his own experimental enquiries. Before this, as early as 1783, the use of the furnace in experimental conduct is often referred to in his diaries:

---

<sup>41</sup> NLS MS 5019 f. 7.

<sup>42</sup> NLS MS 5019 f. 9.

<sup>43</sup> NLS MS 6330 f. 38.

Went into another room with Lavoisier, Seguin and Le Measurier they were [with] a furnace for melting Platina by means of vital air - the main body of it is somewhat on the principle of the furnace used in the foundaries of Leith walk at Cooper and Marks, several contrivances were thought of for introducing vital air.<sup>44</sup>

Hall's ideas for experimenting had their origin on this early Grand Tour. In Vienna, he describes in some detail the experience of a furnace whilst on a visit to a steel mine. They bear similarities to his later compression experiments:

Monday 10<sup>th</sup> [1784]; I got up before nine and went to see the steel works, the ore is put into a furnace with a flux and when it is heated enough it is let out in a mould made of broken slag - while at a heat it looks like milk. When the mould is full the hole is stopped with clay and water is thrown on the metal which concentrates at the surface in curdles.<sup>45</sup>

It was not until July 1798 that Hall began to use the experimental method for obviating difficulties in geological theory in earnest.<sup>46</sup> Hall called his notebooks 'Chemical Experiments made with a view to obviate some of the difficulties in Dr Hutton's theory of the Earth' and they give daily accounts between 1798 and 1816 on, firstly, 'Whinstone and Lava' until 1801 and secondly, on 'Compression' for the next fifteen years.<sup>47</sup> Hall's motivation for these empirical pursuits was clearly theoretical as his opening statement suggests:<sup>48</sup>

Dr Hutton's supposition that the unstratified bodies of the earth have been melted by fire and that stratified bodies have been connected and consolidated into their present form likewise by means

<sup>44</sup> NLS MS 6330 f. 166. Monday, 6 June 1783.

<sup>45</sup> NLS MS 6325 f. 24.

<sup>46</sup> The literature boasts many references to this particular decision of Hall's and included are the words of Hutton (1795). Hutton did not favour those who "Judge of the great operations of the mineral kingdom from having kindled a fire and looked into the bottom of a little crucible" (*Theory*. 251.). This has often been quoted in other studies of Hutton and is therefore known in existing literature. It is why I have placed it in a footnote. Most recently it has appeared in Dean (1992), 88; and Eyles (1961), 213. Mention of Hall's decision to refrain from experimentation from 1790 can also be found in Laudan (1987), 133.

<sup>47</sup> The notebooks made by Hall are in NLS MS 5019 and 5020 and cover a period of almost constant experimentation for eighteen years (1798-1816). The experiments made are mostly concerned with 'Compression' and culminated in a paper read to the Royal Society of Edinburgh on the 3 June 1805. It was published in its *Transactions*, in (1812).

<sup>48</sup> Yearley (1984). This case study in the sociology of scientific knowledge argues that Hall's early reputation was brought about, not by the work itself, but by 'labels' attached by other scientists in responding to it. Yearley shows that attempts were made either to completely discredit Hall's work, Murray (1802), 249-50; Kirwan (1802), 22; or play down its theoretical significance, Playfair (1964), 79 & 305, Bakewell (1813). This led to a distorted vision of Hall's work as not carrying theoretical significance. It is clear, however, from Hall's experimental log books that his theoretical stance holds firm and as Yearley also points out, it began to receive greater recognition some years after his death in Lyell's *Principles* and in Murchison (1839), 43.

of fire in some measure renders it necessary that those who maintain his opinions should be able to show that none of the phenomenon are consistent with this hypothesis and were it possible to imitate the operation of nature in the mineral kingdom the system would by that means be reduced almost to a certainty.<sup>49</sup>

Hall began to conduct experiments earlier than 1798. As early as 1790, he worked on compression experiments but, unwillingly and disagreeably - perhaps out of respect for his mentor James Hutton - he refrained from continuing them. Hutton's disdain for experimentation was based on matters of scale and time, arguing that the grand operations of nature could not be duplicated with any such accuracy as to warrant them acceptable. Hall spoke of this point of contention in 1805 when he read his paper, *Effects of Heat modified by Compression*, to the Royal Society of Edinburgh:

I urged him, [Hutton], to make the attempt [compression experiments]; but he always rejected this proposal on account of the immensity of natural agents, whose operations he supposed to lie far beyond the reach of our imitation; and he seemed to imagine, that any such attempt must undoubtedly fail, and thus throw discredit on opinions already sufficiently established, as he conceived, on other principles. I was far however, from being convinced by these arguments, for without being able to prove such arguments; that any artificial compression to which we could expose the carbonate would effectively prevent its calcination in our fires, I maintained that we had as little proof of the contrary, and that the application of a moderate force might possibly perform all that was hypothetically assumed in the Huttonian theory. On the other hand I considered myself as bound, in practice to pay deference to his opinion in a field he had so nobly occupied and abstained during the remainder of his life, from the prosecution of some experiments with compression which I had begun in 1790. In 1798 I resumed the subject with eagerness.<sup>50</sup>

Hall began his notebooks again on July 26 1798. They show that experiments were conducted, often on a daily basis, for the next eighteen years of his life. Hall called them 'Experiments on Whinstone and Lava'. Hall's earliest experiments provide the best evidence for a significant advance in theoretical geological knowledge, namely the discovery of igneous sequences or rock suites, compositionally homogeneous but texturally different depending on the rate of cooling. To this end, if Hall can be heralded a revolutionary in any way, it is not through his experimental geology *per se*, but rather the contribution his experimental results had for understanding igneous rocks as compositionally similar whatever their texture.

---

<sup>49</sup> NLS MS 5019 f. 1.

<sup>50</sup> Hall (1812), 75-6.

### 6.4.1 Whinstone and Lava

Hall's first full experiments in favour of Huttonian theory were conducted in 1798 on 'Whinstone and Lava'.<sup>51</sup> Published in the RSE's *Transactions* in 1805, the paper received its first public reading at two meetings on 5 March and 18 June, 1798. Hall tried to tackle in what was in his words "a plausible objection to which it [Dr Hutton's geological system] seems liable".<sup>52</sup> The objection, was that granite, porphyry and basalt were thought to have flowed in a state of fusion but their 'stony' internal structure ran contrary to this hypothesis. Hall himself observed in the first instance that flow in perfect fusion resulted in the appearance of a smooth glassy interior.

Hall began to make experiments with Whinstone on January 17 1798 at a foundry on Leith walk owned by a Mr Barker. He experimented on seven different Whins in total initially by heating the samples in a crucible in a large furnace for fifteen minutes. The samples were reduced to a glass by strong heat and then at a temperature between 28 and 30 Wedgwood.<sup>53</sup> After trying the samples he found that they softened in a range from 38-55<sup>w</sup>, the glasses, from 15-24<sup>w</sup> and the artificial crystallites from 32-45<sup>w</sup>.<sup>54</sup>

The first attempt produced, when cold, "a whin in state of compleat [sic.] glass".<sup>55</sup> What Hall also noticed was that at the base of the crucible the mass was more compact. "I observed what I see to be the beginning of crystallisation towards the bottom which I conceive to be owing to the time that it remained in the fire - had that been continued it would probably have crystallised".<sup>56</sup> On January 27 he successfully achieved crystallisation that resembled Whin and, in doing so, discovered that the rate of cooling

---

<sup>51</sup> Dean (1992), 89. According to Dean, Hall was advised by Thomas Hope to operate first on basaltic rocks. However no reason is given as to why these rocks should be favoured. Speculation might be that basalts were thought to have the greatest relevance for seeking proof of the action of heat as an agent of formation at the time.

<sup>52</sup> Hall (1805), 43.

<sup>53</sup> NLS MS 5020 f. 180-185. Yearley (1984), fn. 3. Units of measurement for heat were conducted in Wedgwood. These pyrometers did not provide a linear scale but were checked against each other and against fixed temperatures like the melting point of certain metals. Hall noted that 22<sup>w</sup> corresponded to the melting point of silver (950°C). Eyles (1961), 214 and Flett (1921), 58 mentions this unit of measurement.

<sup>54</sup> Hall (1805), 75. 'Table of fusibilities'.

<sup>55</sup> NLS MS 5019 f. 3.

<sup>56</sup> NLS MS 5019 f. 3.



was fundamental in establishing its appearance, "I succeeded in a manner sufficiently decided for the first experiment and that promised more compleat [sic.] success".<sup>57</sup>

Hall explained this by reference to a difference in behaviour between 'Individual affinities' (substances in a state of separation) and 'affinities of combination' (substances in a state of flux) depending on the level of the temperature. Hall noticed that in higher temperatures a higher rate of flux could be observed and that the 'affinities of combination' would supersede those of individuals:

As the mass cools that superiority must diminish till at last a balance takes place...something similar that takes place in common green bottle glass, when cooled rapidly in its first stages it fixes on a state of uniformly transparent and perfectly homogenous, when cooled slowly as when left in a considerable mass to cool in a glass house pot it assumes a totally different character being opaque, crystalline and (as Dr Hope and I found in the specimen at Leith) consisting of crystals of substances differing from each other in colour and in the form of crystallisation likewise possessing hardness and a high degree of infusability...it is probable that the perfection of crystals will bear proportion to the length of time to which this period to which it can be extended.<sup>58</sup>

Hall was not fully convinced, however, that this operation alone would suffice. Thomas Hope had also suggested that it was not clear that the original crystallised structure of the basalt had been fully destroyed. Hall insisted that the only test of the validity of the theory would be if the effect could be reversed:

if we can perform the crystallisation in a rising as well as in a falling temperature or as Mr Geddes expresses it in annealing up as well as down...by thus fixing the temperature of the furnace and placing the melted substance in it we shall be able to accomplish a perfection of crystallisation.<sup>59</sup>

It took many attempts for this to be accomplished. Constant attempts both in Mr Barker's and Sir George Mackenzie's smaller furnace failed. Hall's log book entries ceased until April of the same year when he noted the company of a "Dr Kennedy", an owner of furnaces and someone whose company he kept for years when doing the experiments.<sup>60</sup> Hall also had a laboratory built at his home in Dunglass where a furnace

---

<sup>57</sup> NLS MS 5019 f. 5.

<sup>58</sup> NLS MS 5019 f. 4.

<sup>59</sup> NLS MS 5019 f. 4.

<sup>60</sup> Dr. Robert Kennedy. Very little is known about Kennedy. He was not widely published but in working closely with Hall he did produce a paper called, "Chemical Analysis of three species of Whinstone and Two of Lava". It was first read before the Royal Society of Edinburgh on 3 December 1798. He worked closely with Hall on the Whinstone and Lava project, Hall saying of him in a footnote (46), "in characterising the particular specimens, I have adopted with scarcely any variation, descriptions drawn up by Dr Kennedy, whose name I shall occasion frequently to mention in the course of this paper".

of his own was fitted. After many failures he eventually got the basalt to re-crystallise. In his paper he described it thus:

All the *whins* employed assume, after fusion, a stony character, in consequence of slow cooling and the success of these experiments with so many varieties, entitles us to ascribe the same property to the whole class. The arguments therefore against the subterraneous fusion of whinstone derived from its stony character, seem now to be fully refuted.<sup>61</sup>

Following the work on Whin, Hall began to use Lavas for his experiments of which he chose six.<sup>62</sup> They had been collected from the Mediterranean region where he had visited in 1785 except one that came from Iceland.<sup>63</sup>

Kirwan and Dolomieu suggested that lavas could never have been completely fused as no glass had resulted.<sup>64</sup> Hall wished to assert some common ground between basalts and lavas, believing them to have both derived as a direct result of heat, albeit at different depths in the earth's surface. Hall set about trying to achieve a comparison and together with Dr Francis Home and friend, Dolomieu (who had accompanied him to Etna in 1785).<sup>65</sup> Hall was convinced – based purely on its external appearance – that a resemblance could be found between these Mediterranean lavas and the whinstone's from his native Scotland. Their 'striking' similarity of appearance (as Hutton had argued) was matched at the chemical or mineralogical level.<sup>66</sup>

Hall's tests produced temperatures in the original lavas of 18-40<sup>W</sup> and for the crystallites, softening in a range of 28-43<sup>W</sup>.<sup>67</sup> The tests revealed a similarity between the respective melting points, suggesting to Hall that the lavas could have resulted from the cooling of melted substances. He claimed to have discovered the identity and chemical similarity of Whinstone and lava and that they were both fusible.

---

<sup>61</sup> Hall (1805), 56.

<sup>62</sup> The lava's used for this experiment were collected personally by, or donated to, Hall. He gave the following description of each specimen, (1812), p. 60-63. 1, Lava of Catania: 2, Lava of St Venere: No 3, Lava of La Motta di Catania: 4, Lava of Iceland: 5, Lava of Torre-del-Greco: 6, Lava of Vesuvius Eruption 1785.

<sup>63</sup> Icelandic specimens were used on many occasions in support of the Huttonian theory. Some were donated by Thomas Allan from his collection and perhaps brought back by John Stanley in 1789. William Hooker brought back specimens in 1809 and most important, Sir George Mackenzie returned in 1810 with over 180 specimens, some of which were used by Hall in geological experiments. See chapter five.

<sup>64</sup> Hall (1805), 57-8.

<sup>65</sup> For information on Hall's observations of Mt. Etna and the surrounding volcanoes, see Chapter Five.

<sup>66</sup> Yearley (1984), 27.

Not just theoretically but methodologically, the paper displayed many of the agents commonly associated with Huttonian work. Hall made constant reference to this language:

These experiments seem to establish, in a direct manner, what I had deduced analogically, from the properties of whinstone, namely that the stony character of a lava is fully accounted for by slow cooling after the most perfect fusion; and consequently no argument against the intensity of volcanic fire can be founded upon that character.<sup>68</sup>

Hall highlighted methodological difference between Huttonians and Wernerians by mentioning Wernerians who disagreed with him, such as M. Dolomieu, whom he praised as a natural historian but highlighted that his science was very different to his own:

Though I differ widely from this gentleman in many of his theoretical opinions, I cannot too strongly express my admiration of his merit as a natural historian. His descriptions of countries, as well as of minerals, present the most lively representations to the mind of the reader, which in the numerous instances I have witnessed are perfectly correct.<sup>69</sup>

In a different intellectual context, Hall had no grievance, noting that he fully admired Dolomieu's abilities in 'describing' rather than hypothesising. Hall went on to note that his work set out, analogically, to go further than merely sight resemblances of lavas in 'external character', but that it must, too, be accompanied by "an agreement no less complete in chemical properties".<sup>70</sup>

Although Hall did not mention Jameson at all in the paper, his other Wernerian problem was encountering disagreements with Kirwan. With respect to lavas, Hall had accused Kirwan of taking for granted without test, suppositions made with respect to glass being the only heat-fused rock. Hall's retort was to take 'testing' one step further in order to derive confirmation, thus:

---

<sup>67</sup> Hall (1805), 75.

<sup>68</sup> Hall (1805), 66.

<sup>69</sup> Hall (1805), 56 fn.

<sup>70</sup> Hall (1805), 57.

I resolved to ascertain the truth of these conclusions in a direct manner, and performed the following experiments with specimens of six different lavas, four of which, to my certain knowledge, had made part of external volcanic currents.<sup>71</sup>

Opposition to Hall on theoretical grounds was overshadowed by the fact that Hall believed himself to be working with a superior scientific method based on analogy and hypothesis. Whilst he respected his rivals' work in a contrasting intellectual context, he also dismissed their lava observations on methodological grounds, stating that hypotheses of formation could not be derived from external characters alone. We are left in no doubt of Hall's theoretical intentions, since, at the end of his paper he noted:

I have now examined the relation between whinstone and lava in various points of view; and the result of the investigation, by showing the intimate connection between the two classes, tends strongly to confirm the ideas of Dr Hutton.<sup>72</sup>

Despite Hall's results, however, there remained one more difficulty that still needed explanation, namely the presence of calcareous nodules that were sometimes found in Whinstones but never in lavas. Hall confronted this with reference to Hutton's notion that decomposition of this material could have been prevented by the pressure mass of overlying strata (now eroded) which would once have covered the basalt. Indeed Hall's own observations on Mount Somma regarding vertical bands of igneous rock suggested that the lower, deeper regions contained calcareous substances whereas the upper portions did not. In answering this, Hall showed Whinstone and lava to be the same, differing only in their condition of formation. In reviving his interest in compression he was able to conclude through experimentation that lavas graded into whinstones by inference that volcanoes could grade into subterranean eruptions and to plutonic rocks. Hall's attention to the conditions under which rocks formed made him return to the problem of compression that had interested him in 1792.

---

<sup>71</sup> Hall (1805), 61.

<sup>72</sup> Hall (1805), 74.

### 6.4.2 Experiments on Compression

In the following years, the presence of calcareous spar within whinstone became more significant to Hall than the whinstone itself. The first attempted explanation of its presence and implications came in Hall's paper 'The Account of a series of Experiments Shewing the Effects of Compression in Modifying the Action of Heat'<sup>73</sup> first read to the RSE on June 3 1805.<sup>74</sup>

The compression experiments were resumed again in March 1801. They occupied Hall's mind almost constantly until 1806, by which time he had completed over 500 experiments using combinations of rock samples, times, and apparatus. Yearley said: "he [Hall] commenced them in great detail and developed their consequences for geological theory".<sup>75</sup>

In essence, the problem was thus: can powdered chalk be converted either into firm limestone or into marble by heating it in a confined space? In this respect, Hutton's theory was in apparent conflict with experimental facts. From general observations Hutton proved that heat and pressure had consolidated limestone and converted them into marbles. It was well known that limestone when heated in an open vessel was transformed into quicklime. Black had shown that carbonic acid had been expelled in the form of a gas.<sup>76</sup> A preliminary account of the results was communicated to the RSE on August 30 1804, and the final paper was submitted on June 3 1805.

In the making, Hall destroyed large numbers of gun barrels in his research.<sup>77</sup> One such description gives a clear account of the danger and destruction that was faced on a daily basis:

My intention was when the heat was risen to 25<sup>w</sup>, to withdraw one tube and pyrometer, then to raise the heat to 30 and withdraw a second leaving the third to cool with the furnace for crystallisation. But standing not far from the furnace I heard a very sharp explosion like the

---

<sup>73</sup> Hall (1812).

<sup>74</sup> Others who have written about Hall's *Experiments on Compression* are Eyles (1961), 214-6, Yearley (1984), 28-30, Laudan (1987), 133; Flett (1921), 61-2 and Dean (1992), 91-92.

<sup>75</sup> Yearley (1984), 28.

<sup>76</sup> Flett (1921), 59.

<sup>77</sup> Flett (1921), 60.

discharge of a pistol. Hoping that only one tube was thus lost I immediately drew out the others and found them all destroyed.<sup>78</sup>

Again in July 1801, he noted:

In another experiment the tube being placed in the muffle and the heat [was] gradually raised to 24<sup>w</sup>. I was about to lower the fire and remove it when the tube burst with an explosion like a pistol. It broke the tobacco pipe lying near it but it was so feeble so as not to injure the muffle.<sup>79</sup>

Despite this, most of Hall's compression experiments were conducted without accident.

On some days he experienced considerable success. On June 13 1801, he noted:

I must say [that] in many of the last experiments I left much air in the barrel in consequence of introducing the cradle first and pouring the lead upon it and that in some experiments with the fusible metal I did obtain some results of absolute compression.<sup>80</sup>

Absolute success with chalk did not come until 1804. By that summer, Hall was able to present twenty-six specimens to the RSE. In the following years, Hall detected numerous problems with his 1804 work. Doubts occurred over the purity of the carbonate and that the encasing porcelain may have artificially aided the experiment. He carried on with the experiments infrequently until 1816.

### 6.4.3 Experimental Spaces: Conditions and Locations

Although strictly a method, I describe chemistry as a 'site' for natural knowledge production in the context of this thesis as it was 'place-centred' in the same way as the museum, the classroom, societies and the field. The importance of a study of James Hall's site for experimentation is that it sheds light on understanding the importance of chemistry not only as method for theoretical verification but as a practical pursuit.

For chemists at the beginning of the nineteenth century, domestic space was important to the production and execution of experiments, and, in some cases to public demonstration. As previously noted, practical demonstration in chemistry at the

---

<sup>78</sup> NLS MS 5019 f. 49. Gunpowder-based compression experiments were often quite dangerous owing to the number of pressurised explosions. Experiments often went wrong and were expensive to set up owing to the number of assistants needed and equipment.

<sup>79</sup> NLS MS 5019 f. 86.

<sup>80</sup> NLS MS 5019 f. 47.

University of Edinburgh was not fully institutionalised until 1823, thus forcing many people to use private premises.

Apart from his home, Hall also occupied a number of foundries on Leith Walk as his diaries reveal: "I have worked in company with Dr Kennedy with his furnaces, sometimes at his house, at Mr Barkers foundry at the glass house and sometimes at my own house".<sup>81</sup> One foundry belonged to a Dr Barker, and Hall also used another smaller one that belonged to Sir George Mackenzie. The diary entries describe in detail the dangers faced and the conditions experienced whilst conducting the experiments on a daily basis.

Experiments were repeated many times, each at slight variance to one another changing the length of time, the size of furnace, the level of the heat, the amount of material. Hall showed himself to be very dedicated to his task, and would, on occasion rise very early; and if necessary, spend most of the night with the experiment: "At half past three I was called and rose - I found the furnace burning well...I rose again at five and set the air to 0.2 - again at eight when I believe I reduced it to 0.1". He described in great detail his procedure in his log-book. This shows that he and his contemporaries would work sometimes in excess of twelve hours in attending to apparatus and recording results. He records a typical day, in April, 1798 when attending to lavas:

*At my house [Dunglass],...Placed two crucibles filled with fragments of basaltic lava of Torre del Greco in Dr K's [Kennedy] small furnace. This lava consists of a grey sandy like base containing black schorls and a few cryolites. The furnace had attained its full heat with apparatus and door fully opened at eleven o'clock. Continued this with vent three feet from the gate until a quarter before twelve when I shut the door leaving only the oval aperture in order to form a settling heat. At twelve took out one of the crucibles, all glass with smooth surface which drew out some melted spots - some small air bubbles - the glass not very clear. Allowed the other crucible to remain another three quarts an hour more in the settling heat, but when taken out was the same in appearance so that I put the two together. Broke up the small crucible of yesterday's experiment containing the glass of St.Venere - some large air hole in the center but the mass very highly crystallised, as much as any we have made - made up of brilliant facettes and numberless flat black crystals shooting into the cavities - in one place a small yellow crystal which looks somewhat like a cryolite. the original lava having a dull sandy grain is far less crystallised than this artificial production. The original is of a light blue, the artificial has a dark bluish cast showing the pitch to be near twenty. I afternoon lighted the large furnace with muffle. Put a piece of St.Venere glass with water of Leith glass at some pitch but softened in one-minute. Wl went in two minutes but not so the St.Venere glass which seemed too crystallise thro' slowly so that they did not seem quite hard short of half an hour. On being broken they were the same, all crystallised and beyond the liver state. About half past seven left piece of this glass in place when number one was with*

---

<sup>81</sup> NLS MS 5019 f. 9.

pyrometer - it indicated 25. Piece of glass beginning to crystallise with incipient spheres. Prepared for a crystallisation of the glass of St.Venere. Shut muffle door - opened whole aperture - put a little crucible empty into the bottom of the muffle. When heated drew crucible to the bottom of the mouth of the muffle and introduced the glass piece by piece, several of them burst and damaged the muffle. When filled set the crucible to the back where we found it in perfect fusion and introduced many other pieces of glass to fill it these when melted to with a quarter of an inch of the brim. The extremity of a muffle had rank before a great heat being now applied. With all men it began to give way all together - drew crucible near the mouth where it was safe and the extremity gradually gave way. This seems to have owing to the fusible [matter] on the outside acting on the muffle which was coupled of materials that would not have yielded themselves viz. Stourbridge clay and lime sand. Shut muffle door and gave one inch of aperture at nine o'clock - having found the whole was perfect fusion and was drawn out of the [furnace]. About ten the matter still soft - reduced to half, I examined and found stiff at surface. Left at half past twelve with half an inch of full coals.<sup>82</sup>

Experiments were, then, almost a full time pursuit and could mean lengthy days in dangerous conditions. Given that Hall's empirical work was conducted in private premises, devoid of public demonstration, the only access a literate public had to his findings was through its publication.<sup>83</sup>

#### 6.4.4 Hall's Experiments in Review

In his experimental procedures and the subsequent publications, Hall ends with a detailed account of the relevance of his work for Huttonian theory. It was clear that the only thing in mind was not to assert unswerving authority to Hutton's original claims but to modify them into workable solutions without losing the basis of it.

Public reaction to Hall continued to be mixed throughout his lifetime and beyond. During the nineteenth century, controversy lasted over the value and merit of his findings for geological theory and the value of the experimental method itself.<sup>84</sup> No satisfactory conclusions were reached. Those who tried to repeat Hall's experiments with porcelain tubes and gun barrels met with similar difficulties and were generally less successful in overcoming them. Gregory Watt repeated Hall's experiments by fusing Cleve Hill dolerite a hundredweight or two at a time, in a blast furnace. The results were not favourable. Other attempts ended in burst gun barrels.

---

<sup>82</sup> NLS MS 5019 f. 14-15.

<sup>83</sup> See Chapter Seven.

<sup>84</sup> Flett (1921), 60.



Hall's papers were overwhelmingly supportive of Huttonian theory, and once again met with references to Jameson, or opposition from Jameson. Hall's work, and the conditions he worked in lead to an understanding of the strong links chemistry had as an adopted 'Huttonian' method. The results of Hall's work, however, were not welcomed by all.<sup>85</sup> Wernerians frankly scoffed; they preferred argument to experiment and the endless discussion over theory went on regardless of Hall's early findings. Murray and Kirwan as we have seen in their responses to the 1798 reading, suggested that nothing could be proved at the level of theory. But there can be no doubt that among those who were not already committed to the principles of Werner the new evidence produced a strong impression and helped to widen the circle of Hutton's supporters.<sup>86</sup> Hall's papers read at the RSE placed the subject of experimental geology in a prominent position and did great service in supporting Hutton's theories. As Hall himself has told us, there were critics who, before the complete account of his researches in carbonate of lime was published, had challenged Hall's notion of accuracy in his conclusions. The ground seems to have been that the materials he worked with were impure and that the glass and porcelain vessels in which he powdered chalk was placed were visibly acted on during the experiment.<sup>87</sup>

## 6.5 Conclusion

Hall is still best known for obviating difficulties in Huttonian theory through his experiments. The experiments themselves gained widespread acceptability in early nineteenth-century Scotland despite the lack of public demonstration. Through these verificatory methods the results or findings were received with mixed feelings owing mostly to the implications the work had for further adding weight to Hutton's claims.

This chapter further shows how methodologically different were the postulations of the Huttonians and Wernerians. Jameson never adhered to nor ever attempted to use or integrate the methods of the chemist into his natural history. Further, he did not use

---

<sup>85</sup> Flett (1921), 59.

<sup>86</sup> Flett (1921), 62.

<sup>87</sup> Flett (1921), 62.

chemical experiments to verify or test aspects of the Wernerian theory, instead believing in description of external characters free from speculation or hypothesis. Wernerians who did disagree with Hall were praised by him as natural historians, or observers, but their methods were subject to criticism, Hall believing them neither good enough nor accurate enough to make categorical statements about the nature of lava and its formation. Chemistry as a 'site' for Huttonianism proved successful.

Here I have also shown how chemistry aided Huttonian geology and was not adopted by Jameson. I have shown that for a variety of sites - societies, the university, museums, the field and laboratories (foundries) - that Huttonians and Wernerians operated in different intellectual and analytic contexts. Another way of confirming this is to turn to publicly available sources and to reaction of geology's promotion and development, as expressed in printed publications and through the operations of the periodical press. In any civic study of the promotion of science, one has to attempt to know public criticism: it is to this I now turn.

## LITERARY PRODUCTIONS: PUBLICATIONS AND THE PRESS

### 7.1 Introduction

This chapter demonstrates contrasting ‘intellectual’ contexts between Huttonians and Wernerians by consideration of the way Jameson’s work was publicly received in contrast to Huttonians. My argument is that whilst Jameson’s Wernerian publications earned him widespread acclaim as a mineralogist, the work was poorly received in Edinburgh.

Natural philosophers of the later Enlightenment did not readily publish their findings, particularly the results of field enquiries. Similarly, papers that were ‘read’ in Society meetings often never made it to the printing press. Secord argues, however, that by the 1820s, publications became more important to the new specialists of the professional sciences as it allowed them to claim control over the ‘places’ and the natural phenomena they discussed.<sup>1</sup>

This use of literary production made it important to geologists that their work be seen and read by others. I first consider the impact of book publications by showing that Jameson, in concentrating on factual contents, aroused very little public attention. In contrast, the Huttonian account of Sir George Mackenzie’s (1810), *Travels in Iceland* with its heavy theoretical bias, caused a considerable amount of public and semi-public interest. This is also true of the scientific journal. As shown in chapter two, Jameson’s Society produced primarily non-speculative or descriptive papers in many topics

---

<sup>1</sup> Secord (2001).

whereas the RSE's *Transactions* were used as a vehicle to purposively promote geological papers with a strong theoretical bent. I conclude with an examination of the reception of Huttonians and Wernerians in the periodical press and show, that in Scotland, it was Wernerians – Jameson in particular - who produced largely factually-based work and who received negative reviews, both because of journalists being Huttonian and because the largely non-speculative nature of Jameson's work was deemed uninteresting. Huttonians in contrast were presented in a favourable light because of their strong theoretical language and statements of controversy.

## 7.2 Geology and the Book: Publishing in Edinburgh

In the early years of the nineteenth century, books on geological topics were relatively difficult to acquire in Edinburgh. This was commented upon by Dr. John Leyden, a visitor to Edinburgh in 1800, who records his attempts to find a copy of Kirwan's *Geological Essays* (1794): "Could any person believe it possible that I lately called at five of the principal booksellers in Edinburgh seeking a copy of Kirwan's *Geological Essays*, and failed"?<sup>2</sup>

Leyden visited Manner and Millar's, Bell and Bradfute's, Creeche's, Hull's and Archibald Constable's without success. They did, however, furnish Dr Leyden with differing opinions of the book. Manners and Millar considered the work highly: "O' Kirwan, the very best author we have on mineralogy". Hull thought it: "d—d trash". By 1819, however, publishing in Edinburgh had undergone a minor revolution in popularity. Lockhart described how much the situation had changed in a twenty-year period:

What a singular contrast does the present state of Edinburgh in regard to these matters afford when compared with what I have been endeavouring to describe as existing in the days of the Creeches! Instead of Scotch authors sending their works to be published by London booksellers, there is nothing more common nowadays than to hear of English authors sending down their books to Edinburgh, to be published in a city than which Memphis or Palmyra could scarcely have appeared a more absurd place of publication to any English author thirty years ago...For my part, if ever I should take it into my head to publish a book, I should most undoubtedly endeavour to get it published in Edinburgh. No book can be published there and be totally neglected. In so small a town, in spite of the quantity of books published in it...indeed, it is only in consequence of

---

<sup>2</sup> Reith (1908), 398.

the frequency with which all this has occurred, that the imprimatur of an Edinburgh bookseller has come to be looked upon with so much habitual respect even in the south. This is surely a very remarkable change.<sup>3</sup>

This change in the frequency of book publishing and in text availability in Edinburgh, and, in turn, the reputation of the city was, in part, due to the rise of the periodical between 1790 and 1820. How is this new-found reputation relevant for the publication and reception of geological material? In the new climate of a political economy of science, I argue that natural philosophers made the best use of Edinburgh's reputation for furthering ideas in natural knowledge. Huttonians and Wernerians published widely, but for very different reasons. This claim can be illustrated by analysis of the contrasting nature of approaches to material by geological writers.

### 7.2.1 A Taxonomic Approach: Jameson's Books

In 1854 Jameson's nephew Laurence noted that "aside from the heavy burden of delivering two courses of lectures per annum Jameson also found extra time in which to undertake many other literary pursuits on a whole range of topics".<sup>4</sup> Jameson's publications were wide ranging and elevated his status to one of Europe's most highly-respected mineralogists. This international reputation is reflected in lengthy correspondence with other natural philosophers from many parts of the world.<sup>5</sup> Yet, as with Jameson's teaching, his reputation did not prevent others from making discerning comments about his writing. Sir Andrew Ramsay's remarks to his brother William in October 1849 are not untypical of the kind of disapproval bestowed upon Jameson:

What awful stuff the Wernerian disciples wrote, to be sure! I am busy analysing Jameson's (of Edinburgh) old writings. He was a disciple and pupil of Werner's, a favourite pupil, and by St. Anthony a Tours, I protest t' ye, it is about as easy to extract buttermilk from millstones, as to make sense out of the maze of words in which they lost themselves. And all too, under the guise of extreme exactitude! But somehow or other, o' nights after a tough day in the air, I don't feel inclined for that dry work...<sup>6</sup>

---

<sup>3</sup> Lockhart (1819), 172-173.

<sup>4</sup> Jameson L (1854), 30.

<sup>5</sup> EUSC Gen. 1996-1999.

<sup>6</sup> Andrew Ramsay to William Ramsay, Capel Curig, 31 October 1849. In Geikie A (1895), 155.

As a sympathiser of the Huttonian school and friend of Archibald Geikie it is perhaps not surprising that Ramsay should remark thus. Apart from finding it impenetrable, Ramsay commented about its dry style.

Jameson first published in 1796. He read before the private audience of the Royal Medical Society (having joined one year before) two papers in opposition to Hutton's theory: The pages were entitled, 'Is the Volcanic Opinion of the Formation of Basaltes Founded on truth?' and 'Is the Huttonian Theory of the Earth Consistent with fact?'<sup>7</sup> These papers were Jameson's first attempt to use publications for countering what he took to be mistaken theoretical propositions. They also highlighted his youthful opinions about the attribution of basalt formation through the action of fire.<sup>8</sup> It was the first semi-public anti-Huttonian stance he made and one of the few to have taken place in the formal setting of a society meeting.<sup>9</sup>

Jameson's first field observations were published in 1798 based on his *Outline of Mineralogy of the Shetland Islands and of the Island of Arran*. Hutton had visited Arran ten years before in 1787 but did not publish any of his findings. Dean aptly describes Jameson's *Outline* as: "the first book length attempt to controvert his [Hutton's] theory on the basis of field evidence".<sup>10</sup> It was published after Jameson's visit to Ireland just a year before in 1797 where he encountered Kirwan's vehement anti-Huttonian protest. Dean has offered a number of arguments about this publication in the context of geological debate, suggesting that Jameson did not attempt to consider Hutton's theory at length but mostly remarked about it in footnotes or asides. In the first of them Jameson chastised a named "late celebrated theorist" for grouping gneiss and several varieties of schist under the general name "schistus". Making a claim against the use of theory he continued: "This want of accuracy is to be regretted." He further observed

---

<sup>7</sup> Dean (1992) acknowledges that Jameson's work was poorly treated by earlier historians and ridiculed by others. Apart from the radical overhaul Jameson needs, and which I have attempted here to the best of my ability, recent attempts have at least tried to portray him and his work more objectively, without citing all of his work as highly theoretically based. See in particular Secord (1991a), (1991b).

<sup>8</sup> Jameson (1796), in Sweet and Waterston (1967).

<sup>9</sup> Dean (1992), 98.

<sup>10</sup> Dean (1992), 99.

“for it is plain, if such confusion be sanctioned, that the science of mineralogy will revert to the unmeaning jargon of a Sir John Hill”.<sup>11</sup>

Dean also suggests that Jameson then controverted Hutton’s revelation that granite is not necessarily a primeval rock and can form later than schist.<sup>12</sup> He noted that Huttonians fallaciously denied the solubility of silex<sup>13</sup> and then cited and seemingly refuted Hutton’s central contention regarding heat, fusion and consolidation,<sup>14</sup> thus denying the igneous origin of granite.<sup>15</sup>

The results of the Hebridean, Orkney and second Arran excursions formed the subject of his next major publication, *Mineralogy of the Scottish Isles* (1800). In contrast to the 1796 papers, Jameson followed the structure favourable to his predecessor of natural history in Scotland, John Walker (to whom it is dedicated) by regarding geological theorising as premature. As already noted in this thesis, the first edition of Jameson’s book made clear his distaste for theory:

I fear that theories of the formation of the earth, interesting as they are, often mislead the mind and pervert the understanding, and those who yield to them become so involved in delusive speculations, so blind to fact and experience that, like archimedes, they find but one thing wanting to raise worlds.<sup>16</sup>

Jameson’s charge that theories would delude the senses eventually turned against him. Though not a conventional travel book, Jameson’s *Scottish Isles* alternates chapters of narrative and mineralogical analysis.<sup>17</sup> Most of the chapters are only slightly revised versions of his 1798 book, though some of the appended references to Hutton were deleted or changed. Some new observations on the mineralogy of Arran consider the possible stratification of basalt. Chapter’s nine to fifteen consider the Hebrides and related geological issues. Volume two continues with the Hebridean Island analysis, the

---

<sup>11</sup> Jameson (1798), 18n, in Dean (1992), 148.

<sup>12</sup> Jameson (1798), 27.

<sup>13</sup> Jameson (1798), 53-54n.

<sup>14</sup> Jameson (1798), 60-61n.

<sup>15</sup> Jameson (1798), 72n, in Dean (1991), 148.

<sup>16</sup> Jameson (1800), I: 11. Also quoted in Chapter Five, 112.

<sup>17</sup> Dean (1992), 100 also gives a brief summation of Jameson’s *Scottish Isles* (1800). He describes it as “not a conventional travel book” with alternations of narrative and mineralogical analysis. However what is missing from Dean’s argument is a full assessment of the nature and impact of the audience to which it

Shetlands (from 1798), the Orkneys and the return to Edinburgh, with additional chapters on Peat and Kelp<sup>18</sup> (both 1798, with additions). Three pages of brief observations by Lord Webb Seymour and John Playfair on the mineralogy of the country between Fort-Augustus and Inverness are included as an appendix. No mention of the supposed fallacy of Huttonian explanations in geology is made or even alluded to in the text.

Jameson continued to publish descriptive books on mineralogy throughout his tenure as professor, persisting in the use of Wernerian classificatory language and the Baconian principles of factual description through inductive principles. In 1804 his *System of Mineralogy* was published, followed in April 1805 with another field-based book, *Mineralogical Description of the County of Dumfries*.<sup>19</sup> In 1808 Jameson published *Elements of Geognosy*, being his third volume of *System of Mineralogy*, widely recognised by many as the most theoretically-driven piece he wrote. Even here, however, Jameson only intimated to making a few inferences and in keeping with factual evidence, noting:

This volume of the *System of Mineralogy* is to be viewed as a sketch of the science of geognosy in its present state. It contains a statement of the best ascertained facts respecting the aspect of the surface, and the structure of the crust of the Earth, and a few inferences, which appear to be legitimate, with regard to their mode of formation. It is intended also as the text book for my lectures of Geognosy. RJ.<sup>20</sup>

Jameson discussed mineralogical matters in 1816 with his *Treatise on the external, chemical and physical characters of minerals* as he also did in 1821 in, *Manual of Mineralogy*. His last publication came shortly before his death in 1849 and was simply titled, *Mineralogy according to the natural history system*, denoting that even as late as the mid nineteenth century, Jameson was still publishing descriptive, taxonomic works. These publications demonstrate Jameson's primary concern to be with mineralogical description.

Jameson did not just write and publish his own findings but also contributed to published works of others, mostly from the scientific travels of his former students.

---

was intended. Aside from description of the two volumes layout, his summation only gives reference to Jameson's mention of Hutton.

<sup>18</sup> Jameson's work on the Shetlands and on 'Peat and Kelp' were originated from Walker (1798).

<sup>19</sup> Jameson (1805). The field notebooks for this publication were compiled in 1802. For more information on Jameson's fieldwork observations, see chapter five.

<sup>20</sup> Jameson (1808), *Preface*. For a breakdown of Jameson's lectures see Appendix Four.



Again, theoretical considerations did not take centre stage in this writing. It is to an examination of these publications, and their reception that I shall now turn.

### 7.2.2 Jameson and the Observation of Others

Along with his status as a highly-respected author, Jameson also contributed to the publications of many of his students, some of whom were pioneer explorers in their own right. Jameson virtually remodelled the fifth edition of Georges Cuvier's *Discourse on the Theory of the Earth* and extended it considerably. He contributed to Napier's *Encyclopaedia Britannica* by writing the articles about mineralogy and geology as well as contributing to the *Edinburgh Encyclopaedia* on mineralogical issues.<sup>21</sup>

His writing activities and contributions to the works of others were not only confined to general science. Jameson undertook specific projects, perhaps the most comprehensive being geological expositions of the Arctic.<sup>22</sup> What resulted was a comprehensive 500-page historical, geographical and geological account of this region and descriptions of the experiences of his former students, Sir John Franklin, Captain Ross, Captain Parry and William Scoresby Jr. Jameson's contribution to their expeditions were extensive:

On the return of Captain Parry from his polar expedition and at the request of that Gentleman, he drew up the specimens brought home a sketch of the geology of the different coasts discovered and touched upon by our enterprising navigator; which was published, together with the botanical observations of his friends, Brown and Hooker, and formed the scientific companion to Parry's interesting narrative. He drew up for the cabinet library an account of the geology of the Arctic regions visited by Captain Parry.<sup>23</sup>

Apart from providing the illustrations for the publication Jameson also wrote the entire section on 'Arctic geology', offering a general survey of all that was known about

---

<sup>21</sup> For an exposition of Jameson's contributions to his student findings in the field, see Laurence Jameson (1854). A comprehensive anecdote giving a full listing of Jameson's literary achievements and memberships of professional organisations throughout the globe can also be found in Kay's *Edinburgh Portraits* (1885), Vol. 2. 271.

<sup>22</sup> The only paper to address Jameson's connections with, and contributions to, nineteenth-century polar exploration is Jessie Sweet (1974). Sweet concentrates on the relations between Jameson and William Scoresby Jr, Charles Geisecke, Morten Wormsköld and Sir John Ross. This work was highly descriptive however, and gave no comprehensive analysis of their activities for the furtherance of nineteenth-century knowledge of the Arctic region. A full-length study of the activities of these individuals and their connections with Robert Jameson is still needed.

<sup>23</sup> Jameson L (1854), 30.

geological structures. The chapter was mostly a descriptive account. There were no anecdotes, and no anti-Huttonian statements, to accompany the use of Wernerian terminology in the discussion of geological formations. Igneous explanations were noted throughout the text to denote expanses of rock that had intruded by igneous heat-induced processes.

Jameson looked for evidence in his student's accounts of vast tracts or large-scale explanation of formations that would support a 'universal theory', but he also pointed out that upon further reflection upon Greenland, the rocks were a mixture of two formations, one of which was igneous. Whilst it did pertain to a broadly Wernerian structure, it had certainly been 'toned-down' from his earlier expositions. There was not any outward sign of the publication being used to counter Hutton's arguments but Jameson did conclude on a semi-theoretical note, denoting the universality and grand scale of nature's operations:

That the islands and lands described in this sketch exhibit the same geognostical arrangements as occur in all other extensive tracks of country hitherto examined by the naturalist - a fact which strengthens the opinion that the grand features of nature in the mineral kingdom are everywhere similar, and consequently that the same general agencies must have prevailed during the formation of the different groups of rocks of which the earth is composed.<sup>24</sup>

Jameson also wrote articles on the physical geography of Africa and India.<sup>25</sup> The Africa book, chiefly about geology, mineralogy and zoology was published in 1834, a collaborative effort between Jameson, James Wilson and Hugh Murray. Chapter seventeen was devoted to an exposition of Africa's geology. A general description was undertaken of great masses that stretched from the north to the south of the country. The Atlas Mountains were termed the *northern region*, the Sahara called the *desert region*, the *eastern region* was Egypt, and a central area called the *Region of the Soudan or Nigritia* represented the largest landmass area. The south was known as the *Great table land of Africa*. Again, most of the phenomena described were not subject to theoretical or speculative opinions regarding the nature of formation. Wernerian terminology was

---

<sup>24</sup> Jameson, in Leslie (1851), 500. So great was the respect for their tutor, that on Scoresby Junior's expedition of the east coast of Greenland, he named a large proportion of it 'Jameson land'. The area still bears the same name today.

<sup>25</sup> Jameson et al. (1830), This article appeared in the Edinburgh Cabinet Library.

used in a section that referred to differences about rising 'Cape Rocks' above the level of the sea. Jameson gave credence, however, to what were two plausible 'Plutonian' hypotheses, a reflection of his general acceptance of the importance of igneous processes by 1830:

The neptunians maintain, on plausible grounds that all these rocks are crystallisations and deposits from the ancient waters of the globe which have taken place in succession... Other plutonians are of the opinion that the slate, greywacke, and sandstone were deposited, in un-interrupted succession at the bottom of the sea and that the whole mass of stratified matter was raised gradually or suddenly above the level of the ocean, forming mountains, by that igneous agency which sent up the granite and probably also the augite greenstone rocks. This of the two plutonian views is the most plausible and indeed is that explanation which may be viewed as most in accordance with prevailing geological hypotheses.<sup>26</sup>

Discussions about theoretical concerns were comparatively rare in Jameson's publications, instead often opting to refrain from opinions regarding their formation. By 1830 Jameson had assigned himself to accepting certain sets of proofs that were put forward in favour of the heat-generated igneous action of formation and was willingly displaying these thoughts to the public. There was no other mention of possible modes of formation with regard to other areas.<sup>27</sup>

In sum, the text of Jameson's books is as descriptive as his teaching. Items of or pertaining to theoretical debate were rare, and, when incorporated, were neither confrontational nor dismissive of igneous explanations. What remained by 1830 was the use of Wernerian terminology with respect to macro-scale formation. This seemed to be the universal case whether it was Jameson's own written researches or based on those of his pupils. Unlike the Huttonian faction, it would seem that Jameson's motive for writing extracts based on the research of his students was not to supply 'proof' of the Neptunian explanation of phenomena, but out of a genuine interest in accumulating descriptive or factual knowledge of other parts of the globe. Huttonians who employed far more militant discourse, sought always to disprove or to provide proof presented to disprove Wernerian tenets.

An example of what might loosely be termed a 'Huttonian approach', in contrast to Jameson, is the writing of that 'arch-Huttonian', Sir George Mackenzie. His

---

<sup>26</sup> Jameson et al (1834), 380.

controversial and sometimes militant discourse may have had greater appeal to public sensibilities than the purely descriptive and dry writing style of Jameson. This 'style' difference further suggests that Huttonians and Wernerians conducted research with different intellectual motives, using different methods and operating within the confines of contrasting contexts for the understanding of nature.

### 7.2.3 Huttonian Language: George Mackenzie's *Travels in Iceland*

Perhaps the finest example of George Mackenzie's accomplishments was his 1810 tour to Iceland. In Chapter Five I discussed the tour's significance as an example of theoretically-motivated fieldwork. Here I consider the promotion of his findings as a 'Huttonian', and the public reception of *Travels in Iceland*. The results of Mackenzie's expedition were highly significant for the nature of geological debate in Edinburgh since Mackenzie returned from Iceland with the most concrete evidence in favour of Hutton's theory.

Much of the evidence provided about the public reception of *Travels in Iceland* comes from the testimony of Mackenzie's companions, Henry Holland and Richard Bright. Both have received attention as distinguished London physicians and upstanding members of Victorian society. It is my contention, however, that Mackenzie, whilst aided significantly by Holland during the Iceland expedition, would nonetheless have found sufficient evidence in favour of Hutton's theory given his commitment to disproving Werner's theory. I will argue this on the basis of his personality, particularly with regard to his conduct upon his return from Iceland.

Another factor in bringing out an argument in favour of Mackenzie's enthusiasm for the Huttonian cause was the contrasting non-partisan behaviour of Henry Holland. His testimony after the return from Iceland and his friendship with Jameson shows that caution and the apparent lack of interest in theoretical concerns expose the existence of a 'centre ground' of opinion.

Despite a distinguished career as a London physician, Holland spent a brief period of residence in Edinburgh between 1806 and 1811. During these years as a medical student

---

<sup>27</sup> This was also the case for the concluding section of the 'African geology' chapter in the book.

he also developed a passion for geology.<sup>28</sup> At a meeting of the RSE in early 1810, he was invited to accompany Sir George on a proposed expedition to Iceland in the summer of that year although Holland was not an outspoken Huttonian.<sup>29</sup>

It is possible that Mackenzie and Holland first became acquainted as students where both attended Jameson's lectures at the University. Wawn described Holland as an "empiricist with Huttonian leanings".<sup>30</sup> This may be true upon his return from Iceland. Before Iceland, however, Playfair's comments on Holland's paper entitled, '*On the Salt Mines of Cheshire*', do not portray him at all as, "Huttonian in character".<sup>31</sup> Indeed, it is the lack of provocation in Holland's speech that may have prompted Playfair's inclusion in the meeting:

Mr P stated the difficulty he had in conceiving that the deposition and consolidation of the strata could have taken place without the agent of heat. I expected some of the Wernerian party to rise here - but on this subject they all preserved a complete silence.<sup>32</sup>

Even in February 1810 Holland displayed a scrupulous high regard for the feelings of others. This sensitivity was based on his knowledge of who would be present at RSE meetings and his awareness of the existence of ill feeling amongst contemporaries:

I know not whether I mentioned to you the disagreement which has occurred in the Royal Society since I was last in Edinburgh - they had relation in a considerable degree, though not entirely to the geological disputes, and their effect was to detach in great measure from the meetings of the society all the Wernerian party. Party animosity is carried so far as to prevent the election of anyone who is proposed by either side as a fellow of the society... the law of election requiring the candidate to have two thirds of the vote given. Out of 11 persons who were proposed last year 10 were rejected in consequence of this unfortunate division of interests - all the Wernerian party are going to the society tonight, P Jameson, Dr Thomson the chemist and Dr Macknight... This is probably in consequence of my intimacy with Jameson; he has expressed much interest in my

---

<sup>28</sup> Wawn (1987), 17. Wawn has shown that Holland was certainly no stranger to geology before 1806. A number of instances which reveal his early taste for mineralogical subjects include his schooling in Bristol (1803-4) where he and Richard Bright (1789-1858) are known to have had access to the mineralogical holdings of the Bristol Library Society. See Wawn's footnote about the influence of Arthur Aikin from whom they received training, the elder son of Dr Aikin of London and passionate geologist with whom Holland spent his school holidays. For more on Holland's activities relating to the foundation of the Geological Society of London, see Rudwick (1962), 325-355.

<sup>29</sup> NLS MS ACC 7515. Although details of Holland's paper are not revealed in his letters or were ever published it would appear that it was free of specific theoretical provocation. It is therefore difficult to claim that Mackenzie's interest was founded on Huttonian Grounds, but out of general acquaintance. Holland said of Mackenzie in a letter to his father on February 6: "I have the opportunity of seeing him [Mackenzie] frequently and have been much gratified by his friendly attentions".

<sup>30</sup> Wawn (1982), 20.

<sup>31</sup> Wawn (1982), 147.

<sup>32</sup> NLS MS ACC 7515 6 February 1810.

chapter, of which I have shown him some parts with a view to his criticism upon them - all of the Huttonian party will be at the society; Playfair, Lord Meadowbank, Lord Webb Seymour, Dr Hope, Dr Allan, and I regret that my friend Sir James Hall is now in London.<sup>33</sup>

Holland's apprehension in giving the paper was indicative of tension in the meeting. There were disputatious ramblings in the RSE with a policy on the part of Huttonians to oust the Wernerian faction from committee posts. It would seem from Holland's testimony that the Wernerian contingent did not instigate acrimony but were made to feel rather unwelcome.

A dilemma may have presented itself for Holland on the grounds of loyalty, but an opportunity to go to Iceland with Mackenzie had emerged and this was too tempting to turn down on the grounds of its potentially disputatious nature. It was certainly due to Mackenzie's proposal that Holland's geological activities grew ever more frequent.<sup>34</sup> His enthusiasm for Iceland, particularly its mineralogy, is clear in his letters:

Everything in fact concurs to render it probable that such an expedition would be productive at once of pleasure and advantage. The pleasure seems to me to be secured by agreeableness of associates, novelty of scene and the many objects of interest that would occur to us. The profit of the expedition would be derived partly from the opportunity of cultivating some desirable branches of knowledge as mineralogy.<sup>35</sup>

From the outset, he was enthusiastic:

To mineralogy, I am already industrially applying myself and with great present advantage, Sir G is providing himself with all the instruments requisite to the excursion...I shall say nothing more on the subject having already given my full statement of the advantages and pleasures which my reason or imagination, attach to the project. You will perhaps think me too sanguine - it is the fault of my age and temperament.<sup>36</sup>

In the months before the expedition, Holland spent much time with Mackenzie. He mentions in particular his weekly visits to Thomas Allan's private mineral collection, describing it as being of a: "splendid kind".<sup>37</sup>

<sup>33</sup> NLS MS ACC 7515 6 February, 1810. See Wawn (1987), 18.

<sup>34</sup> NLS MS ACC 7515 17 February, 1810.

<sup>35</sup> The 21 letters that Holland wrote to his father between 6 February 1810 and September 18 1811 are housed in, the National Library of Scotland accession archive, no. 7515. The letters reveal one of the most in-depth accounts of the nature of debate in Edinburgh societies and the relative lack of positive action Wernerians took in that overall process.

<sup>36</sup> NLS MS ACC 7515 17 February, 1810.

<sup>37</sup> NLS MS ACC 7515 4 March, 1810. For a greater discussion on the significance of the mineralogical cabinet of Thomas Allan for civic interest in matters geological see the discussion in Chapter Four.

Sir G called on me this morning to take on some matter relative to our preparations for Iceland. His own preparations are now entirely complete. I shall see him again tomorrow at Mr Allan's in whose cabinet of minerals we propose as usual to pass the morning.<sup>38</sup>

It was not just Allan that Holland befriended whilst in Edinburgh. He had a very productive social life spanning all times of his day, from breakfasts to daily engagements and large evening gatherings.<sup>39</sup> His contemporaries displayed a range of geological views. Sir James Hall, John Playfair, Lord Webb Seymour, Thomas Hope, and George Mackenzie were his Huttonian companions. He was also, however, particularly close to Jameson and, apart from attending his class, would take walks with him to look at local geological features.<sup>40</sup> Holland sometimes breakfasted with Thomas Thomson (1773-1852), and was acquainted with Thomas Macknight (1762-1836), both founding members of the WNHS.<sup>41</sup> Holland valued Jameson's guidance and expertise. During the delivery of his paper in February 1810, there was Wernerian support for him, which was, in Holland's opinion, a result of his closeness to Jameson.<sup>42</sup>

After Iceland, the Huttonian influence on Holland appeared to be much greater.<sup>43</sup> The letters resume with vigour in January of 1811 and show Holland to be constantly busy. He attended meetings of the RSE to hear Sir George Mackenzie's papers on Icelandic mineralogy,<sup>44</sup> breakfasted with Lord Webb Seymour, dined with Thomas Hope and walked with Sir James Hall, paying regular visits to Dunglass, the Hall family estate. Holland also spoke of gatherings that consisted mostly of Huttonian supporters.

Holland's letters reveal that he was aware that the Icelandic specimens would be used as a valuable anti-Wernerian weapon, as would the accounts of Mackenzie, who

<sup>38</sup> NLS MS ACC 7515 12 April, 1810.

<sup>39</sup> NLS MS ACC 7515 8 April, 1810.

<sup>40</sup> NLS MS ACC 7515 16 February 1810. In April of 1810 Holland recalled an account of a proposed geological tour to the Pentland hills with Jameson. Other friends of a Huttonian persuasion expressed a desire not to attend, but it did not deter Holland. He said: "Tomorrow we set out at nine o'clock for the Pentland Hills and probably shall not return until later in the day the direct distance being five or six miles, and there being much to do in the way of mineralogical observation. Dr Jameson attends us. Sir G Mackenzie and Mr Allan do not join the party".

<sup>41</sup> NLS MS ACC 7515 17 February 1810. Thompson and Macknight attended meetings of the Royal Society of Edinburgh and were present to hear Holland's paper *On the Salt Mines of Cheshire*.

<sup>42</sup> NLS MS ACC 7515 6 February 1810.

<sup>43</sup> This statement is based on the fact that upon his return Holland is less willing to account for his Wernerian friends in his letters to his father.

<sup>44</sup> NLS MS ACC 7515 28 January 1811.

never appeared afraid of conducting geological discourse of a provocative nature in public.<sup>45</sup> Iceland seems to have produced a slight Huttonian 'turn' in Holland but his writing was still carefully worded as to convey relative neutrality. This is particularly true in his account of Mackenzie's paper, read to the RSE on 20 January 1811:

On Monday evening there was a very large meeting at the Royal Society and Sir G Mackenzie's third paper on the mineralogy of Iceland was read...you will be surprised to hear me say that it was a very interesting paper and exceedingly well composed - a remark which I am not singular but which has been repeated to me from various quarters...Sir G openly attacked the Wernerians, many of whom were present, no reply was made nor indeed do I know what could have been said in contradiction...upon the whole I have seldom heard a better paper.<sup>46</sup>

Mackenzie's evidence combined with his oratory skills and the prime motive of ousting the Wernerian faction won through. What the letters also seem to show is that the Huttonian party was prepared for geological confrontation in the face of a new mood of confidence. Numerous accounts of Holland's point to a Wernerian party that was unwilling to engage in any acrimonious discursive interaction:

I expected some of the Wernerian party to rise here - but on this subject they all preserved a complete silence<sup>47</sup>...When speaking of Obsidian, Sir G openly attacked the Wernerians and no reply was made.<sup>48</sup>

Further:

On Monday evening Mr Allan's paper on the rocks of Salisbury Crags was read at the Royal Society to a crowded meeting - all the Wernerians were present but though several attacks were made upon their doctrines not a syllable was said by any one of the party.<sup>49</sup>

And:

On Monday evening I was at the Royal Society to hear Sir G's paper on the more theoretical parts of the mineralogy of Iceland. It went off very well. Several subsequent remarks were made but exclusively by the Huttonian party, the Wernerians, as usual refraining from anything like discussion.<sup>50</sup>

---

<sup>45</sup> Whilst the experiences of the voyage have been meticulously recorded there has been rather less information given about the impact of the voyage for understanding its influence on geological debate in Edinburgh and in particular, Jameson and other Wernerians reaction to the findings.

<sup>46</sup> NLS MS ACC 7515 28 January 1811.

<sup>47</sup> NLS MS ACC 7515, 6 February 1810.

<sup>48</sup> NLS MS ACC 7515, 28 January 1811.

<sup>49</sup> NLS MS ACC 7515, 10 March 1811.

<sup>50</sup> NLS MS ACC 7515, 24 March 1811.



What requires explanation, however, is why little Wernerian resistance was forthcoming. This is somewhat difficult to explain in the first instance. Why did they not respond to challenges laid before them? Holland's observations may also point to the need for a revised account of the nature of geological debate. As I have shown, Jameson's work and his methods in a variety of intellectual contexts points to the need to view the nature of his Wernerianism in a new light. In this instance, the reception and delivery of the respective disputants also differed.

A number of explanations for this is possible: either there was caution being exercised so as not to cause disturbance, or perhaps a form of 'geological apathy' had ensued, in particular amongst Wernerian ranks. The argument throughout the thesis based on different intellectual contexts seems far more plausible. Holland may be representative of a section of literati who, in advocating principles of polite conduct, appeared non-partisan.

Previous historical accounts present the Hutton-Werner debate as an acrimonious series of events based on absolute differences.<sup>51</sup> However the lack of reaction to the findings by Wernerians has relevance for a new understanding. Whilst there is no absolutely clear explanation for Wernerian silence in formal meetings, the argument of 'intellectual context' cannot be dismissed in presenting a new version of events. I wish to argue that Mackenzie's book still marked a significant turning point in providing proof against Wernerian theory. The impact was particularly prominent in the public realm. Here the situation was far from 'silent'.

#### **7.2.4 *Travels in Iceland*: Theatre and Public Performance**

Mackenzie made no secret of his motive for undertaking the Icelandic adventure. In 1826 he revealed to the University Commissioners that "It was with the view to ascertain the origin of the trap formation of rocks, and which was disputed between the

---

<sup>51</sup> I think, in particular of earlier histories such as Gillispie's *Genesis and Geology* (1959). In the setting of the reception of literary productions as well as Jameson's own operations, many of the tenets of geological debate were being argued from the perspective of contrasting philosophical and methodological foundations.

Huttonians and Wernerians that I went to explore Iceland”.<sup>52</sup> The book being very partisan and scathing to Wernerians, there is little wonder that elements of the dispute spilled out into the civic environment. Wawn’s paper on Mackenzie’s play ‘Gunnlaug’s Saga’ provides perhaps the best example of the kind of hostility the book caused. Wawn shows that the negative response to the play was less about the quality of the acting, and rather more, a reflection of political concerns about geology. Whilst I am convinced that Wawn concentrates to some degree on the ‘reaction’ of Wernerian geologists, I hope to make some useful additions here.<sup>53</sup>

Mackenzie wrote a play called “*Helga or the rival minstrels of a tragedy founded on an Icelandic Saga*” which was performed at Edinburgh’s Theatre Royal in January 1812.<sup>54</sup> In the initial stages, he announced his attention to Sir Walter Scott in whose Battalion he served in their military days. The apologetic tone revealed that he was all too aware of his inadequacies in the realm of literary pursuits:

I have no excuse to offer for the trouble I am about to give you than the mutual interest I have somehow or other taken in the story of Gunnlaug...The request that you will have the goodness to pursue, the [sort] that you will not [think] me capable of believing it worthy of your notice - my desire being only to possess your opinion which, I assume, will be candid and should that opinion be favourable to obtain your kind advice in opening my first poetical baby...might I request of you to inform me as to what time may I call for you to go over this said tragedy which I have called “*Helga or the Rival*”...I need hardly mention that I wish my having attempted to write a play to go no further.<sup>55</sup>

---

<sup>52</sup> Mackenzie to the Commissioners, *Evidence* 1, 619.

<sup>53</sup> Whilst I use Wawn’s studies as a framework, it must be noted that the Wawn studies are written with an ‘Icelando-centric’ focus. I shall concentrate on the results of the Iceland findings in an Edinburgh context, particularly how it relates to Jameson and the Wernerians, and not necessarily to Mackenzie himself.

<sup>54</sup> Sir George Mackenzie’s Play (anon) on “*Helga or the Rival Minstrels*” is currently held in the Larpent collection, Huntington library, California no.1751. The title page gives a brief outline of the play as “Opens with Haco arriving in Iceland. Haco and Edgar were once friends, but became rivals after the king of Sweden judged Edgar’s poem on love better, Haco goes to Iceland in order to win Helga, Edgar’s intended for himself. Helga and Haco have been engaged for three years while Edgar has been travelling. Now the promised three years are up, Edgar has not returned and Haco claims that Helga has been abandoned. Hermann, Helga’s father, agrees to the new match as Haco’s father Arthur is wealthy and powerful. Helga attempts to delay the marriage in order to wait for Edgar. In the meantime, Holkar, Edgar’s friend reports to Edgar’s father Harold that Edgar was delayed at sea by storm. He also reports the results of the contest at the Swedish court, which reveals Haco’s motive. During the wedding feast Edgar arrives and challenges Haco to duel. In two melodramatic scenes Helga’s maid Emla, persuades Helga’s father to renounce his preference for Haco and Holkar convinces Arthur that his son has betrayed his friend. But all the parties arrive too late to prevent the duel in which the contestants kill each other and Helga ends the play with a scene of Ophelia-like madness.

<sup>55</sup> NLS MS 3880 f. 147. Letter of Sir George Steuart Mackenzie to Walter Scott about his intention to construct a play in Edinburgh.

Predictably, the play met with hostility by a group of Wernerian geologists intent on bringing about its early closure. Sir George wrote again to Sir Walter Scott, this time regarding its cessation:

The row last night I find has been complained by the Wernerians, I was left by two of my own class. I hear you would not be pleased with the manner in which the prologue was spoken - I regret that your goodness should have led you to be connected with a dammed play; that is the only regret I feel. I resolved not to subject myself again to the ill nature of personal enemies and have withdrawn my play - I am always...etc etc.<sup>56</sup>

The incident was so noteworthy that Sir Walter Scott mentioned it in a letter to the playwright Joanna Baillie on the 4 April 1812:

As for Sir Geo [sic] Mackenzie's play it was dammed to everlasting redemption as elbow says and that after a tolerable fair hearing. The most mortifying part of the business was that at length even those who went as the authors friends caught the infection and laughed most heartily all the while they were applauding. The worthy Bart. Has however discovered that the failure was entirely owing to a set of chemists call'd Wernerians who it seems differ in their opinion concerning the cosmogony of the world from Sir George's sect of philosophers, the Huttonians. This has proved a most consolatory discovery to his wounded feelings.<sup>57</sup>

As Wawn asks, why should 'a set of chemists called Wernerians' have seen fit to allow scientific controversy to wash over into the theatre in this way? In what way is it significant? It is, to some degree, a consequence not just of the publication and its findings but the manner in which it was articulated. Holland's testimony to his father is again quite revealing. These letters describe inherent difficulties in coping with Mackenzie's forceful and arrogant personality. This was caused by his refusal to recognise properly Holland's contribution to mineralogical discoveries. In the book Wawn says,

Holland's letters describe the difficulties of scholarly collaboration with as incautious a colleague as Sir George Mackenzie's tendency to appropriate, with little or no acknowledgement, and then to exaggerate or distort the findings or materials – particularly mineralogical materials – was a source of considerable irritation to the fastidious and learned Holland.<sup>58</sup>

---

<sup>56</sup> NLS MS 3882 f. 1. Letter of Sir George Steuart Mackenzie to Sir Walter Scott (1812) regarding the withdrawal of a play.

<sup>57</sup> *The Letters of Sir Walter Scott*, (ed.), Greirson, III, 101. In Wawn (1982), 139.

<sup>58</sup> Wawn (1982), 141.

A play may have demanded a certain discursive style, acceptable in a civic environment.<sup>59</sup> Mackenzie's conduct had clearly breached polite codes and, in this context, he would have been subject to ridicule. As examples of this arrogance, some extracts of fervent anti-Wernerian sentiment from *Travels in Iceland* are given here, just a few of many throughout the geological section of the work:

It is surely more reasonable to infer the existence of internal heat from the phenomena of volcanoes, than to believe in the Wernerian rising and falling waters of the globe without the evidence of any analogous fact whatever. It is plain, that as the Wernerians cannot prove by any analogy that the waters did actually rise and fall, or support their assumptions other than by round assertions, they cannot direct their attacks with consistency against what the Huttonians have assumed from evident and striking analogy.

Further:

It would not be a difficult task to shew the weakness of the arguments by which the Wernerians imagine they have proved that the origin of obsidian and pumice is not igneous. They talk much of demonstration, but I must confess my utter inability to discover where anything like it is to be found either in the writings of Werner, or those of his followers. I shall not, therefore, take up the time of the reader with combating a phantom.<sup>60</sup>

Mackenzie's writing style and his arrogant and domineering manner caused a great deal of acrimony. Sir George had a point to prove to the Wernerians which he executed in Edinburgh's public and semi-public spaces. The reaction to this, although seemingly silent in Society meetings, met with public scorn in the theatre setting. The style of Mackenzie, without tarring other Huttonians with the same brush, does at least show that there was more passion to promote theory amongst Huttonians and demonstrates, along with Hall's lifetime devotion in experiments, how importantly they viewed the cause. Wernerians did not respond to attacks well or often and very rarely produced works of a purely theoretical nature.

### 7.2.5 The Scientific Journal

A similar pattern emerges for publications in scientific journals. Journals have been used since scientific societies emerged. Their importance for the specialist in securing a wider audience was only fully realised in the early part of the nineteenth century. Pyenson and

---

<sup>59</sup> For a detailed discursive study of polite conduct in late Enlightenment Scotland see Dwyer (1987).

<sup>60</sup> Mackenzie (1810), 364-6. In Wawn (1982), 149.

Sheets-Pyenson argue that the scientific paper or journal article eventually displaced the book as the appropriate showcase for scientific work.<sup>61</sup>

Chapter two showed how the respective journals for the RSE and the WNHS differed in their approach to the nature of geology, with one journal promoting theoretical works more than the other.<sup>62</sup> One such proprietary publication for Jameson was the *Edinburgh Philosophical Journal*, which also, in part, mirrored the broad nature of topics for scientific investigation as the *Wernerian Society Memoirs*.

The editorship of the *Edinburgh Philosophical Journal* was another one of Jameson's many scientific engagements. The journal was begun with David Brewster at the suggestion of Jameson's friend and fellow *Wernerian*, Dr Patrick Neill. This partnership broke down after a series of ill-natured personal wrangles between Jameson and Brewster. After 1826, Jameson became the sole editor and duly renamed the journal the *Edinburgh New Philosophical Journal*. Jameson himself published extensively in his own journal throughout its early years: after 1830 he contributed no further works at all.<sup>63</sup>

By 1854 at the time of writing, Laurence Jameson noted this journal to be a worthy scientific achievement saying: "It now extends to seventy volumes and is, we believe, admitted to be the most valuable repository of scientific information in Britain for the period of its existence". This emphasis for Jameson was clearly to further works in natural history. For Brewster this was not the case. Laurence Jameson went on to say: "earlier volumes contain not a few contributions from himself; and besides numerous original articles from other hands, the journal comprehends translations of memoirs from the French, German, Italian and Swedish languages, with many communications from correspondents on the all the branches of natural history. It will form one of the most durable monuments of his talents and industry".<sup>64</sup> These specialised journals relied, however, on specialist audiences and, subsequently, circulation was not widespread. They were eventually replaced in popularity by more 'general' or popular

---

<sup>61</sup> Pyenson and Sheets-Pyenson (1999), 218-221.

<sup>62</sup> For greater detail of the specific differences between the *Memoirs of the Wernerian natural History Society* and the *Transactions of the Royal Society of Edinburgh*, see Chapter Two.

<sup>63</sup> See bibliography for list of Jameson's publications.

<sup>64</sup> Jameson L (1854).

science journals. This initiative also responded to the interests of an increasingly literate middle or professional class. To serve the interests of this wider audience, scientific issues were addressed in more controversial and unorthodox circumstances. More theoretical material was reviewed. Published articles began to receive criticism.

Unlike the journal where the author of the article could determine relative bias, open criticism exposed the public to biased accounting from others. Author and editor no longer had control of public opinion: neither did the journalist. I shall demonstrate that the consequences for Jameson in particular were quite considerable in this context since it increased the chance of his being falsely portrayed by Huttonians. It is to a consideration of geology, and of Jameson by the Edinburgh press that I now turn.

### 7.3 Geology and the Edinburgh Periodical Press, 1800-1820

The 'scientific' periodical became a useful mode of criticism that went hand-in-hand with the development of professionalisation in science in the nineteenth century.<sup>65</sup> Broman (1994) has noted that: "While periodicals offered an opportunity for "the public" to come together over matters of common interest, those same periodical genres also opened the door to the formation of more specialised groups of readers".<sup>66</sup>

<sup>65</sup> Koss (1981) argues that the periodical press assumed its modern form during the Mid-Victorian age. Newspapers had a vastly enlarged readership owing to the repeal of stamp duty in 1855, making it a far more powerful political tool. The rise of the press and the periodical as a fully engaging instrument of criticism was essentially a nineteenth-century phenomenon. It had its origins in Edinburgh early in the century.

<sup>66</sup> The periodical played an important part in European Enlightenment learning with editors, writers and readers profiting from the practice of literary journalism. However, studies of scientific criticism in periodical literature are extremely scarce. And yet the use of the periodical as a tool for understanding the public reaction to issues relating to science and the relationship between literature and science could be useful to address questions of the portrayal of early scientific work and the nature of its dissemination in the *civic* environment. Alvar Ellegård's 1958 study, *Darwin and the General Reader: The Reception of Darwin's Theory of Evolution in the British Periodical Press, 1859-1872* attempts to analyse science in periodical literature. Although methodologically flawed the book did attempt to use periodicals to answer the key historical question of the relationship between science and its representation in popular literature. Other useful studies are Koss (1981), and Cranfield (1978) although the promotion and reception of scientific issues were not discussed in any detail Goodman's cultural study of eighteenth-century France points to the book review and extract as crucial to the republic of letters, noting that in France, the number of journals more than doubled between 1740 and 1780. Goodman further points out that the periodicals served as useful communicative and informative tools, by publishing announcements of projects to which citizens could subscribe (Goodman 1994, 165).

As instruments for criticism, journals were typical creations of the eighteenth century but did not emerge fully until the Victorian period.<sup>67</sup>

Between 1711 and 1800, no fewer than seventy-three new papers and journals arose on Edinburgh's streets.<sup>68</sup> They had a multitude of names, ranging from the obscure like *The Bee*, the *Ghost* and the *Lounger* to the sensible such as the *Edinburgh Herald*, or *Edinburgh Gazette*. They covered a multitude of topics to cater for specialist interests such as the *Edinburgh Museum* or the *Scots Farmer*.<sup>69</sup> To an ever increasingly literate public, demand for information was higher in the eighteenth century. These journals contributed highly to dissemination of public interest in things.

During the first part of the nineteenth century this set of conditions continued and led to the emergence of yet more journals and papers designed to provide critical acclaim (or not) to the endeavours of late Enlightenment scholarship. Scientific issues were often reported in Edinburgh's periodical literature, with topics on early geology and natural history widespread throughout the first part of the nineteenth century, covered a range of theoretical and descriptive perspectives. The periodical, therefore, played a crucial role in civic culture by popularising science. The case of geology and geologists in the Scottish periodical is highly relevant and was dominated mostly by activities in one journal in particular: the *Edinburgh Review*. I shall therefore devote most attention to it.

### 7.3.1 The *Edinburgh Review*

The most important journal for geological coverage was the *Edinburgh Review*. Founded in October 1802 by Sydney Smith, Henry Brougham, Francis Jeffrey and Francis Horner, their reputation quickly gained critical acclaim and, arguably, changed the way popular journalism was to follow into the nineteenth century. Its critical stance changed ideas relating to book selling with its open and sometimes malicious attacks on authors. Lockhart said of its inception:

---

<sup>67</sup> Habermas (1962/1989), 41-45. Also discussed in Goodman (1994), 168.

<sup>68</sup> Couper (1908), Vol. 2.

<sup>69</sup> Couper (1908), Vol. 2.

The first manifestation of the new state of things was no less an occurrence than the appearance of the first number of the *Edinburgh Review* – a thing which wherever it might have occurred, must have been a matter of sufficient importance, and which appearing here was enough not only to change the style of bookselling and the whole ideas of booksellers, but to produce almost as great a revolution in minds not so immediately interested in the result of the phenomenon.<sup>70</sup>

According to Lockhart, literature and journalism in Edinburgh had been dominated by the *Review* and was without ‘feeling’ in interpretation. When *Blackwood’s Magazine* arrived in 1817 he noted:

There was for a long time no more thought among the Scottish reading public of questioning the divine right by which Mr Jeffrey and his associates ruled over the whole realms of criticism than there is in China of pulling down the cousin-german of the Monn and all his bowing court of Mandarins...the influence acquired by the Edinburgh reviewers over the associations of the great majority of Scottish minds was not an influence accompanied with any views of philosophy calculated to enoble human nature, or with any genial or productive spirit of thought likely to draw out the genius and intellect of the country in which their *Review* was published.<sup>71</sup>

By 1820 many thought the *Edinburgh Review* had dominated literary criticism, and, in doing so, had adopted a policy of criticism without just feeling or adoration, in the first twenty years of the nineteenth century:

The *Edinburgh Review* cared very little for what might be done, or might be hoped to be done, provided it could exercise a despotic authority in deciding on the merits of what was done. Nobody could ever regard this work as a great fostering mother of the infant manifestations of intellectual and imaginative power. It was always sufficiently plain that in all things its chief object was to support the credit of its own appearance. It praised only where praise was extorted – and it never praised even the highest efforts of contemporary genius in the spirit of true and genuine earnestness which might have been becoming; even in the temple of their adoration the reviewers still carried with them the swell and strut of their own worldly vanity; and in the midst of their most fervent devotions it was always easy to see that they conceived themselves to be conferring honour on the object of their worship.<sup>72</sup>

The reviewers were seen by many as wholly dominant and with a particular style of approach that was willing to bestow praise readily. Given these conditions and the

---

<sup>70</sup> Lockhart (1819), Letter 21.

<sup>71</sup> Lockhart (1819), Letter 24. The letters indicate that Lockhart viewed the *Edinburgh Review* as not only having power over literary criticism in Edinburgh in the first part of the nineteenth century, but also displaying criticism in a harsh manner, without ‘feeling’. In the same letter, Lockhart describes how resistance to this dominance was occurring: “there had already been formed in Scotland a considerable body of rebels to the long undisputed tyrannical sway of Mr Jeffrey and his friends”.

<sup>72</sup> Lockhart (1819), Letter 24.



potential influence the reviewers must have enjoyed over Edinburgh's literati, the topic of science and the *Edinburgh Review* has received relatively little systematic investigation.<sup>73</sup>

Studies of this periodical have taken place in the context of political and economic reform. Clive presents the *Review* as a journalistic and literary phenomenon addressing its powers as a political and religious tool. Pottinger, in his *Heirs of the Enlightenment* considers the *Review* to be a nineteenth-century phenomenon despite Edinburgh in 1802 clearly retaining many of the traits and institutions that characterised the eighteenth century.<sup>74</sup>

Recent scholars have concentrated on the character of the *Review* as it is traditionally known – as a political enterprise. Fontana (1985), has combined this view with an assessment of the factors that gave it intellectual significance. Yet Fontana failed to acknowledge contribute to the role of scientific ideas in setting the social and political agenda. John Lockhart's portrayal of the power and influence of the journal upon the minds of the reading public was made very apparent in his observations. Lockhart wrote at length about the *Review*, owing mostly to his friendship with Francis Jeffrey. His friend, Mr Wastle, painted a picture of the *Reviewers* under Jeffrey as highly sceptical.<sup>75</sup> Lockhart continued in the same vein:

The system of political opinions inculcated in the *Edinburgh Review* is in like manner, as I honestly think, admirably fitted to go hand in hand with a system of scepticism; but entirely irreconcilable with the notion of any fervent love and attachment...<sup>76</sup>

Despite the very sceptical outlook, the *Review's* Whig stance and disdain for religious fervour inherited from the philosophers of "the last generation" exerted considerable influence over its Edinburgh readership. When *Blackwood's Magazine* emerged in 1817

---

<sup>73</sup> Clive (1957), Fontana (1985), and Pottinger (1992) pay little attention to the role and coverage of issues in natural philosophy yet discussion of these topics formed a very large part of the subject matter of the *Review's* criticism, geology in particular.

<sup>74</sup> Clive (1957), 17.

<sup>75</sup> Lockhart (1819), Letter 20. Mr Wastle was thought to have said, "He regards the scotch philosophers of the present day, and among or above the rest Mr Jeffrey and the *Edinburgh Reviewers*, as the legitimate progeny of the sceptical philosophers of the last age;...Mr Wastle is accustomed to talk of Mr Jeffrey as having initiated a bad and destructive species of mental exertion among his countrymen, or at least as having so far assisted the natural tendency towards some such species as to have merited in no inconsiderable measure the dispraise, both present and future, with which the initiator of any such species must of necessity lay his account".

<sup>76</sup> Lockhart (1819), Letter 20.

Lockhart said of the *Review*, “those who have thrown off all allegiance to the *Edinburgh Review* cannot divulge themselves of its influence”.<sup>77</sup>

The *Edinburgh Review* is perhaps the most interesting of the Edinburgh periodicals for its coverage of, and involvement in, geological issues in the early part of the nineteenth century. This is because its inception coincided with what has been phrased the ‘Heroic Age’ and was heavily influenced by writers whose close connections to geological writers and scholars are well documented. I shall show how the intellectual significance of the *Review* was apparent in its coverage of early geological issues and identify its impact upon the Wernerian party in Edinburgh.

Aspects of geological controversy spilled over into the journal from Edinburgh’s Societies and the University arena as Dean has argued.<sup>78</sup> Beginning from the *Review*’s inception in 1802, John Murray’s anti-Huttonian piece, ‘Comparative View’, appeared in the first edition. Written with the appearance of neutrality, it was, in fact, a Wernerian response to Playfair’s *Illustrations* and marked the beginning of geological controversy through the periodical:

Professor Playfair’s book naturally called for an answer from some of the disciples of Werner. A ‘Comparative view’ of the two theories however, is by no means a proper title for this publication: it contains a violent attack upon the doctrines of Dr Hutton, and a very partial and zealous defence of the aqueous solution of minerals.<sup>79</sup>

John Playfair’s close connections with the *Review* are well known, through his friendship with Francis Jeffrey. According to Dean (1992), however, Jeffrey dealt with the *Illustrations* unsympathetically but Jeffrey was unsympathetic to geology *per se*, also treating Murray’s *Comparative Review* with the same disdain. 1803 the *Review* was still largely undecided as to its firm allegiances:

As we have not yet had the good fortune of being converted to either system, we may boast at least of perfect impartiality in considering this controversy; though we are afraid that neither of the belligerent parties will be very ready to acknowledge the merit of our neutrality.<sup>80</sup>

---

<sup>77</sup> Lockhart (1819), Letter 20.

<sup>78</sup> Dean (1992), 148.

<sup>79</sup> *Ed Rev*, Vol. 2, No. 4 (1803), 337.

<sup>80</sup> *Ed Rev*, Vol. 2, No. 4, (1803), 337.

According to Dean, it was not until Gregory Watt took over from Jeffery in 1803 as the resident geological critic that the *Review* was first used as a vehicle to gain a wider audience for orthodox Huttonianism. This was achieved through a series of geological commentaries.<sup>81</sup> Watt gave no quarter to the Wernerians: as Dean revealed, "In the issue for April 1804, reviewing Scipio Breislak, and again in July reviewing Dolomieu, he [Watt] pointedly included and rejected Wernerian alternatives".<sup>82</sup> By 1803, the *Edinburgh Review* sided with Huttonian ideas, as was made clear in volume two:

We may begin, therefore, with remarking, that in contrasting the Huttonian and Neptunian theories, it appears to us not be to quite fair to urge any objection against the former, that does not apply strictly to the hypothesis of the igneous fusion and consolidation of minerals. The advocates of that theory have indeed taken a much wider range and have advanced many very questionable positions as to the constant agency of their internal heat and the great and eternal circle of destruction and renovation in which they have supposed the materials of the universe to revolve. The Neptunist professes to explain the present condition by the supposition of a previous dissolution in water; but he neither tells us what was its state before this great dissolution was accomplished nor ventures to provide for the reparation of its apparent decay: his theory reaches neither the past nor the future; it accounts for present appearances only and therefore cannot enter at all into competition, or comparison, with any system that carries its conjectures beyond the beginning and the end of the world.<sup>83</sup>

Upon this official announcement, there was little to stop the reviewers. Watt's comments were scathing. But Jameson's discomfort did not end after Watt's death in 1804. James Headrick, another devout Huttonian, sought to use the *Review* as an instrument of ridicule and attack, not dissimilar to the ideological approach many Huttonians adopted in promoting their theory. Headrick first attacked Jameson in 1804 when he reviewed his *System of Mineralogy Vol. 1*. From the outset, Headrick's comments were unfavourable:

It is not without considerable hesitation that we determined to take any separate notice of the volume before us...Mr Jameson, I'm afraid has not attended very carefully to the possibilities of lives and survivorships of modern books or he never would have deferred the exposition of his explanatory *vitalium* to so dangerous a distance...it might possibly escape an authors modesty, indeed, that his work was likely to become obsolete before he rendered it comprehensible; but to the malicious perspicacity of a reviewer, such a possibility occurred with instinctive readiness.<sup>84</sup>

Further:

---

<sup>81</sup> Dean (1992), 165-8.

<sup>82</sup> Dean (1992), 148.

<sup>83</sup> *Ed Rev*, Vol. 2, No. 4 (1803), 338.

<sup>84</sup> *Ed Rev* Vol. 5, No. 9 (1804), 64.

Mr Jameson seems to have contracted an enthusiastic attachment to that system called the Wernerian:...the slightest observation that falls from him is fulsomely announced as a discovery, every discovery assumes the merit of priority; and every assertion is demonstration...the disciples of Werner admit to no inspiration but his [Werner's].<sup>85</sup>

Failure to look beyond the tenets of Werner, stylistic and linguistic concerns were not the only fault Headrick desired to expose. He also cited many examples of Jameson having merely copied Werner. When gathering information for a volume on mineralogy, Headrick suggested that: "this however, Werner has done for Germany, and this Mr Jameson has undertaken to do for Britain. A mere translation from foreign authorities will in no respect suffice".<sup>86</sup>

As I have shown, Jameson was hostile to verificatory methods. Headrick clearly played Jameson's inductivist stance down as 'lesser' science and assigned the methods used by Huttonians greater merit. Despite some of Hutton's own scepticism towards chemistry as a corroborative tool (of which fact Headrick made no mention), this shows that Jameson adhered much less to corroboratory tools of investigation used by the 'theorists' instead preferring descriptive methods and inductive processes. Theory through verificatory means was, however, clearly preferred by the *Review*:

The observer never proceeds with so much ardour as when he theorizes; and every effort to verify, or disprove various speculations, necessarily leads to the introduction of new facts and to the extension of the limits of real knowledge..<sup>87</sup>

In 1805, Headrick again wrote a similarly dismissive account of Jameson's *Mineralogical Description of the County of Dumfries*. He argued that there was not any factual content in the work. Readers in the *Edinburgh Review* were subjected to the following:

Our surprise however, and disappointment were both considerable when, instead of the facts and practical observations which the title taught us to expect, we found ourselves plunged all at once into the profundities of a new theory, the grounds of which are not explained; and overwhelmed with a tedious detail of hypothetical reasonings and conjectures...for our own part we have already entered out protest against the introduction of these barbarous and dissonant appellations and can conceive no other motive for the display of so much irregulative erudition, but Mr Jamieson's [sic] unbounded admiration for the tenets and speculations of the Wernerian School.<sup>88</sup>

<sup>85</sup> *Ed Rev* Vol. 5, No. 9 (1804), 64.

<sup>86</sup> *Ed Rev* Vol. 5, No. 9 (1804), 77.

<sup>87</sup> *Ed Rev*, Vol. 1, No. 1 (1802), 201.

<sup>88</sup> *Ed Rev*, Vol. 6, No. 11 (1805), 229.

As Jameson's field notes show, firm evidence is provided to render these allegations in the *Review* rather misleading. The mode of observation was practical in nature and did not have recourse to theoretical rhetoric. The title of the volume, however, did purport to include much Wernerian language but Headrick used it to deliver another scathing attack. He concluded in this manner that he began:

Upon the whole, it is perfectly apparent that in place of a mineralogical account of Dumfriesshire, Mr Jamieson [sic] has only been solicitous enough to find a vehicle for his newly acquired theory from the school of Freyberg. A less devoted disciple indeed would have measured the theory by the facts; but in the volume before us the facts are made to suit the theory; and in what manner has this reconciliation been effected it has been the object of this review to point out...the author indeed seems always to labour, and not without success, to render himself unintelligible; probably imagining that the more he plunges out of the reach of ordinary capacities, the more profound he will be esteemed.<sup>89</sup>

Dean fails to analyse the effect these damning reviews had for the reputation both of Jameson and the Wernerians. Although the *Review* had only disparaging remarks for Jameson, the journal had a profound impact for the nature of geological debate as a whole. By not presenting Jameson in a favourable light, a reading public would have derived more sympathy for a Huttonian perspective if they were regular readers of the *Review*. In presenting Jameson merely as an imitator of his German mentor, extra sympathies may have lain with Hutton through his portrayal in the *Review* as 'home grown'. Headrick not only damned Wernerians, but by not assigning originality to Jameson he also portrayed the doctrine as a non-Scottish creation.

The *Review* not only wrote scathing articles about Jameson's work but also openly supported claimants who opposed him. When referring to arguments between Jameson and Playfair, the *Review* sided with the views of the latter:

We were very much struck with an objection which Mr Playfair quotes from Mr Jameson and to which he seems to us to have made rather a triumphant than a satisfactory answer. Mr Jameson had asked how it happened that the granite, if projected in a fluid state from below, did not overflow the country, as soon as it had penetrated the shistus above it, and how much a theory could be reconciled with the existence with Mont Blanc, and other granite mountains? – Mr Playfair has answered, that the shistus was not penetrated; that it was bent merely, and raised up, and that the granite was formed and cooled within it, as in a mould, and only appeared when the injuries of the weather had worn this external coating.<sup>90</sup>

<sup>89</sup> *Ed Rev*, Vol. 6, No. 11 (1805), 245.

<sup>90</sup> *Ed Rev*, Vol. 1, No. 1 (1802), 213.

The *Edinburgh Review* was neither supportive toward, nor did it hold, Jameson's work in high regard. This might have had a profound impact on the way Jameson was perceived and respected and might have led to many false interpretations so apparent in literature about the nature of his geological work and the methodological basis upon which it rested.

The review of Playfair ends with more eloquent and sanguine language than any work of Jameson's. This set a precedent for the *Review* in its partisan approach to matters relating to geological theory. Huttonian work received criticism but overall it was praised. Papers with a Wernerian slant were almost always criticised and subject to wholly negative and sometimes even misleading comment. In contrast to Headrick's review of Jameson's work in Dumfries, Playfair's review in 1802 ended thus:

The ability with which he has combined the complicated materials of the subject, and the correct and luminous order he has observed in the statement of a loose and analogical argument, have given a precision and scientific unity to the system of Dr Hutton, in which it was formerly deficient. The talk therefore of its advocates adversaries, will hereafter be comparatively easy, since it is scarcely possible for any question to remain, as to the tenets it maintains, or the arguments by which they are to be supported. The work is therefore highly worthy of perusal, and deserves to be considered as by far the most able elucidation and vindication of the Huttonian theory, that has yet been presented to the public.<sup>91</sup>

In reinforcing the general pro-Huttonian stance and the methods adopted in its production, the *Review* did not stop at praise for Playfair's eloquently crafted Huttonian expositions. Sir James Hall's publications also received favourably worded responses, giving the public more confidence in the Huttonian system and in its modifications. In 1806, Hall's *Account of a Series of Experiments Shewing the Effects of Compression in Modifying the Action of Heat* was reviewed and subject to independent scrutiny. There was no doubt that the experiments themselves were undertaken solely for the purposes of verifying basic tenets of Hutton's theory. In extending praise, the *Review* accounted:

Indeed there is but one way in which a geological theory, or any theory, where the causes are beyond the reach of actual observation, can produce more evidence than a *synthetical* argument like the preceding is able to afford. This happens when the principle of the theory being first assumed,

---

<sup>91</sup> *Ed Rev*, Vol. 1, No. 1 (1802), 216.

in consistency with known facts, is afterwards found to explain in a simple and satisfactory manner, a very varied and complex system of phenomena.<sup>92</sup>

The author, although cautious, gave adequate credence to the Huttonian system as supported by Hall's scientific methods:

It is not for us, who pretend not to the character of geologists and only venture to give an opinion here as on the matter of general science, to say whether the theory invented by Dr. Hutton, and so ably supported in the paper before us, is in full possession of the advantage just stated. The time perhaps is not yet come when this question can be brought to a complete decision and when philosophers can determine fully, whether the element of fire or of water is the consolidating power of the mineral kingdom. One thing however, is evident, that a theory which like Dr Hutton's which comes forward, assuming principles that are shewn by experiment to be true, and conformable to nature, is entitled to a fair hearing in all its parts, and is not to be rejected without a very accurate comparison with the phenomena of geology on the one hand, and with the conclusions of different theories on the other.<sup>93</sup>

Hall's chemical system was deemed by the *Reviewers* to be a wholly adequate replication of naturally-occurring events and was, therefore, given credit as a system to which Hutton's theory could rely for verification. They endorsed and encouraged his research to continue:

With the exclusive possession of this powerful engine, no inducement can be wanting to engage him in the further application of it to geological or chemical researches. Among them are many familiar to that which is here so successfully investigated.<sup>94</sup>

Recognising the Huttonian bias, it is still difficult to assess the impact upon the general public and the persuasive ability of the *Review* in convincing readers interested in geological matters to adopt Huttonianism. The nature of Jameson's Wernerianism was clearly misread in the reviews, given the new evidence presented in this thesis. It might have led a public to believe that he was vehemently more anti-Huttonian or theoretically driven than he actually was and in so doing fuelled controversy over geological theory and tarnished some of Jameson's reputation as a credible natural scientist.

Largely 'false accounting' of Jameson did not just rest with the written word. Pictorially, he was represented in caricature as the 'child of Werner'. To some extent, he was but it serves to show that this defined who Jameson was in the Edinburgh

---

<sup>92</sup> *Ed Rev*, Vol. 5, No. 17 (1806), 19.

<sup>93</sup> *Ed Rev*, Vol. 5, No. 17 (1806), 31.

<sup>94</sup> *Ed Rev*, Vol. 5, No. 17 (1806), 31.

periodical press. This specific 'identity' portrayed Jameson as a geological 'puppet'. A sketch made by John Kay, arguably the most important figure for publishing caricatures of Edinburgh literati during the Enlightenment shows Jameson's character in a picture called, *The Craft in Danger* (*Kays Portraits*, 1817).

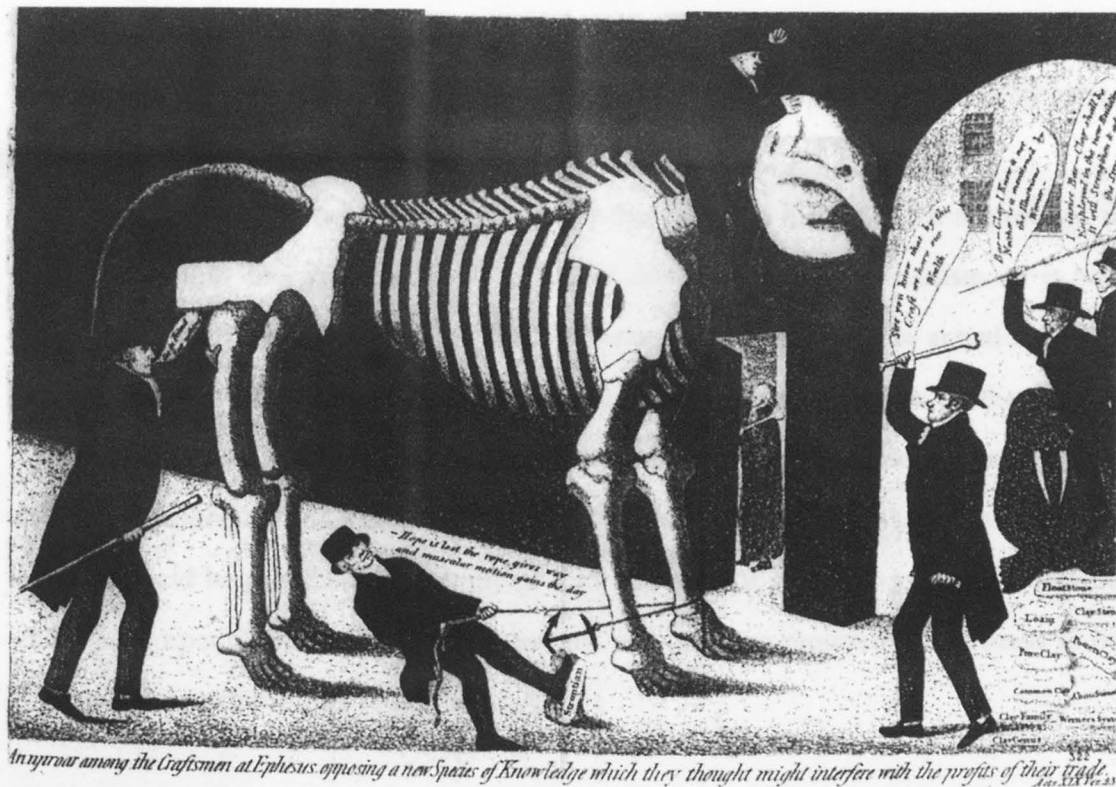


Figure 12. *The Craft in Danger*, by John Kay, (1817). Picture From *Kay's Portraits* Vol. 4. Printed by permission of the National Library of Scotland.

As the story is told in *Kay's Portraits* (1817) Vol. 4 the picture shows Jameson as a conservative, trying to preserve a threat to his chair by the proposed introduction of a professorship of comparative anatomy. Jameson (second from right) is seen beating back the new professor who is riding into old college on the skeleton of an elephant. The proposed candidate for the chair, Dr Barclay, is seen riding on the elephant and in the bottom right hand corner, there are building blocks or characteristics of Jameson's persona to identify him. Jameson is quoting the following words: "Bar – clay I know it not neither is it mentioned by the Illustrious Werner". Below there is also a block



labelled, 'Werner's system'. The pictorial representation showed Jameson in a 'Wernerian light' but did not make a distinction as to the precise nature of Wernerianism he subscribed to.

Jameson's public face as expressed by the press was wholly negative. His image as a generally unexciting professor, his reputation for bestowing upon the public works devoid either of anecdote or analogy, and his attention to Baconian inductive methods as a means to the production of natural knowledge, all contributed to a negative reputation for him.

Jameson was portrayed as being strongly theoretical in his approach to geology. It would seem that the press misinterpreted the *nature* of his Wernerianism as it was expressed through Jameson's use of Werner's terminology and not the actual methods he used for scientific investigation. For this reason, Jameson made the perfect enemy for the Huttonians, an enmity that we now know to be founded on contrasting intellectual principles and practices. What follows is that it calls into question whether Jameson could be classed as an 'enemy' if the principles of scientific investigation were wholly incompatible concepts. If this is so then was Jameson required by the press to be the 'enemy' in order to fuel conflict?

## 7.4 Conclusion

In this chapter I have achieved two things. The first is to highlight the point that Jameson's publications differed methodologically from Huttonian publications. This demonstrates that the argument of 'intellectual context' was not just a product of activities in production of knowledge and various sites, but was also reproduced in publications, for public consumption.

Judging by the reaction of the public toward Huttonian and Wernerian publications, one can guess 'the mood of the people' as demanding more speculative science, based on verification of theory, hypothesis testing and analogy, than the dry catalogue-of-events style of publication that was often associated with Jameson. This further highlights differences between them based on methodological procedure. By the

public reaction to Mackenzie's play, one can suggest that the public were stirred by controversial scientific writing that purported to make speculations on a large scale, rather than books that merely described animals, minerals and plants.

Secondly, an influence upon this public opinion was the reaction of the Edinburgh periodical press toward Jameson, in contrast to Huttonians. The *Edinburgh Review*, the most popular Edinburgh periodical between 1800 and 1820, especially favoured Huttonian explanations, and, in so doing, falsely portrayed Jameson as less scientific despite his standing as one of Europe's leading mineralogists.

In this chapter, I have examined not just what Jameson actually did but the way he was perceived by a literate public. By suggesting this perception was based on false notions, the thesis concludes by showing how the evidence gathered here about Jameson may be brought together for a new understanding of his role in geological debate. In coming to better understand Jameson's role, this thesis has uncovered some of the real reasons for the occurrence of geological debate as based less on theoretical rivalry, and, rather more on the methods by which theory should be conducted and as a consequence of social and political interests within Edinburgh's civic environment.

## CONCLUSION: ROBERT JAMESON, GEOLOGY AND THE EARTH SCIENCE COMMUNITY, 1796-1826

### 8.1 Introduction

This thesis began with the premise that a study of Jameson's geological thinking and activity would help in understanding the nature of geological debate in early nineteenth-century Edinburgh. From the outset, the goal has also been to bring into sharper focus the state of, and public interest in, the earth sciences in Scotland in the first two decades of the nineteenth century. It has also been motivated by a concern to review past issues in a new light.

Despite many studies of geology in the Victorian period, the Huttonian-Wernerian controversy has been largely marginalised since the 1960s.<sup>1</sup> Whilst it has been my contention here that rivalry between theories is an over-simple and insufficient explanation, this thesis has suggested that a new understanding of the question has to begin with making Jameson a central figure. From such new knowledge of Jameson, a far more complex picture has emerged than the orthodox view of ascendancy of one theory over another. In the light of this work, the classical account of a 'pitched battle' between rival sides carries little weight as a sufficient explanation of motivation behind the events. As Oldroyd shows, the classical interpretation of closure was shown with *élan* by Gillispie ([1951] 1959):<sup>2</sup>

---

<sup>1</sup> A recent attempt to revive discussion was Rupke (1994).

<sup>2</sup> In Oldroyd (1996), 106.

the great issue seemed to be whether fire or water should have precedence in a theory of the earth. Neither side can be said to have 'won' the debate. Victory was claimed by the vulcanists, but it was decisive only on quite a narrow front, namely the origin of Basalt. On larger issues, including such grand questions as the origin of granite, debate has continued through to the present.<sup>3</sup>

As I have shown in chapter seven, if we choose to view the debate in purely theoretical terms, the so-called 'victory' had taken place after Sir George Mackenzie's return from Iceland. With Robert Jameson seen here as more centrally an inductivist, who used the natural history classificatory method and who made theoretical judgements on accumulations of gathered evidence rather than through verificatory measures, new questions have arisen as to whether theoretical rivalry might not now be seen as occurring in contrasting intellectual contexts. There certainly was rivalry and this is not in dispute here. I have put forward an argument, based on study of Jameson's activities that the 'classical account' oversimplifies, and which, specifically, does not consider social factors such as scientific 'ownership', institutional authority, personal reputation and the proprietorial control of local scientific knowledge.

That Jameson was opposed to Huttonian theory, especially before 1817, is not in dispute. What is not so clear, however, is the extent of that opposition on methodological grounds. Firstly, as a Wernerian, Jameson was opposed to Hutton's claims. I have argued, however, that Jameson was opposed because of disdain for verificatory methods and in some cases because of a Baconian leaning that favoured taxonomic ordering over theoretical reasoning. In *Elements of Geognosy* (1808), arguably the most theoretically-driven piece Jameson wrote, he was unequivocal about the importance of empirical observation forming the key to any credible science:

We should form a very false conception of the Wernerian Geognosy, were we to believe it to have any resemblance to those *monstrosities* known under the name of *Theories of the earth*. Almost all the compositions of this kind are idle speculations, contrived in the closest, and having no kind of resemblance to anything in nature. Armed with all the facts and inferences contained in these visionary fabrics, what account would we be able to give of the mineralogy of a country, if required of us, or of the general relations of the great masses of which the globe is composed? Place one of these speculators in such a situation, and you will immediately discover the nature of his information, and he himself will find that he knows nothing; that he has been wandering in the

---

<sup>3</sup> In Oldroyd (1996), 106/7.

mazes of error; and that however easily he may have been able to explain the formation of this globe, and of the universe, he cannot give a rational account of a single mountain.<sup>4</sup>

At the end of the book, when discussing Huttonian theory, Jameson also remarked:

We may remark that a considerable degree of practical experience in observing nature, and tracing the connections of mineral formations, is required to render us capable of applying the principles of the Wernerian Geognosy, and even of duly comprehending its value, as a faithful picture of the mineral Kingdom”<sup>5</sup>

Greenough also referred to Jameson as more Baconian in outlook than the Huttonians. He wrote of the theoretical excesses of the Huttonians, but according to Greenough, leaders of both parties had been guilty of attempting an explanation of geological dynamics instead of simply describing what they had observed. Whilst Greenough’s grievance with Jameson was not so much on the grounds of theory, he only accused the Wernerians of errors in observation.<sup>6</sup>

As I have shown in my introduction, other observers, recent and past, have presented Jameson in a purely theoretical light and have tended in so doing, to neglect a diverse scientific career in mineralogy and natural history that was based upon Baconian taxonomic principles. I have tried to present here evidence to demonstrate that this and other claims about Jameson are misguided and misinformed.

In view, this thesis has tried to advance evidence to substantiate arguments that orthodox accounts of geological debate in Edinburgh in the early part of the nineteenth century have been based on the assumption that Jameson’s life in geology was spent more in defending the Wernerian geognostical theory than in the taxonomic pursuit of a Baconian natural history. I have demonstrated by looking in more detail at Jameson’s methods of natural knowledge construction in a multitude of settings, that the theoretical aspect of his science has been distorted. Further, the methods used between Wernerians and Huttonians for the making of theoretical claims have not been portrayed as contrasting. This has had the effect of underplaying any understandings based on the intellectual context to natural knowledge.

---

<sup>4</sup> Jameson (1808), 42.

<sup>5</sup> Jameson (1808), 344.

<sup>6</sup> Greenough, *Critical Examination*. In Gillispie (1959), 90.

In the biographical discussion in Chapter One, it has been seen that Jameson's early activities and interactions with other people were dominated by matters relating to natural history, notably in his relationships with John Walker who similarly eschewed theory.

In Chapter Two, thorough examination of the Wernerian Society showed that it should not be viewed as the staunch Wernerian theoretical vehicle it was once understood to be. Issues relating to geology, and, even more, to theory, were much more prominent in the earlier volumes but they certainly did not dominate society meetings in the same way that they dominated meetings of the RSE. The Wernerian Society often discussed empirical pursuits in natural history and had a membership who used it chiefly to further discussion of earth science and natural history as an amateur pastime or hobby. In the same way I have shown that the RSE was used for the furtherance and active promotion of the Huttonian theoretical cause, notably so after 1811.

Chapter Three discussed Jameson's role as lecturer in the University of Edinburgh and showed through an examination of both his *style* of teaching and in terms of the subject content, that although he taught geology according to a Wernerian schema and with use of Wernerian terminology, this was in its early years just one section of his true interest of mineralogy undertaken using Baconian taxonomic methods. From his syllabi, we can see that it was not until the 1820s that Jameson even had a separate section for geology in his lectures, Jameson making it his 'sixth' mode of enquiry.

Although Wernerian theory was not foremost in Jameson's overall teaching agenda - a fact which is corroborated by examination of the notebooks of students who took his course - the geology section was taught according to Wernerian principles of formation. We also see a gradual incorporation of plutonic or igneous concepts into the Wernerian schema after 1827.

In Chapter Four, the principal contention advanced is that Jameson's geological activities in his museum show that geological debate over theory was less a consideration in his refusals to allow access than issues of economics, social status and ownership of property. The examination of Jameson's dealings with Huttonian

collections revealed that his proprietary concerns centred upon the assertion of civic reputation and control through property ownership. Considering Huttonian collections in private hands has also revealed that Jameson was not disposed to using his museum widely as a tool either for promoting or defending Wernerian theory. Rather, management and presentation of his collections reflected a Wernerian descriptive schema.

I argued in Chapter Five that Jameson's favourite mode of knowledge production was through geological fieldwork. This is principally, I suggest, because fieldwork encompassed the Baconian principles of direct and empirical observation of nature. By revealing the methodological nature of Jameson's actual field practice through examination of his previously unmentioned field notebooks, I have been able to demonstrate the complexities involved in field practice. I have shown, too, that although theoretical considerations were present in Jameson's field observations, they were rarely mobilised – as were the Huttonians' – for refutatory purposes. Indeed, as his teaching shows, Jameson readily incorporated plutonian concepts into field observation when he was convinced that there was sufficient evidence to do so.

Chapter Six further demonstrated Jameson's commitment to Baconian inductive methods by showing what he did not do rather than what he did. By examining verificatory procedures in geology through chemical experimentation and defining the procedure as a refutatory Huttonian method chiefly adopted by Sir James Hall, I have documented Jameson's Baconianism through assessment of his non use of this potential tool. Previously unexamined letters reveal Jameson's distaste for chemistry. Jameson did not advocate the use of chemical techniques as a tool either for promoting or for defending the Wernerian theory.

Closer inspection of Jameson's published works - in Chapter Seven - has revealed a broadly similar scientific trend to his empirical endeavours. Most of his works were not concerned with theoretical propositions. In contrast, Huttonians used the medium of publication in order to promote theory.

In sum, Jameson stands here revealed not as an unswerving adherent to Wernerian theory, as a lifelong devotee of Baconian empiricism, the inductive principles

upon which it was based and upon the virtues of the taxonomic or natural history method of classifying as credible science. Jameson was someone who conducted his science in a variety of intellectual contexts and whose ideas underwent gradual modifications over time. Jameson's achievements in the earth sciences in the early nineteenth century were extensive and, until now, have been largely overlooked by historians. I have shown that as a man of science Jameson's achievements and contributions to Enlightenment and Victorian natural science have been extensive and very much overlooked by historians. What, if anything, remains still to know? I shall conclude with some individual thoughts about Jameson.

## 8.2 Reflections on Robert Jameson

This thesis has throughout emphasised a new understanding of Jameson and his scientific activities by placing his undertakings within a broader intellectual context. What I have shown is that his activities as a whole can be understood in relation to different settings, from his teaching, to his use and control of the museum, through his Society, in his journals and in publications which had a great bearing on his role as a debater of geological theory. But what does this tell us of Jameson's character?

I have tried to suggest here that, although a Wernerian, Jameson did not promote his beliefs in a narrow or focussed way, but did so as a part of a much wider range of scientific activity in which theoretical engagement did not have a central place. Others would concur in this representation of Jameson. Thus for George Wilson:

Side by side with some of the narrowest opinions, which he held and defended most obstinately, was a wise and intelligent sympathy with the progress of every department of physical science. Nor was this sympathy inactive. The Wernerian Society which he founded, named after a mineralogist but including every class of naturalists, and discussing every branch of their science, was one evidence of the catholicity of his tastes. Another was the Edinburgh philosophical journal, the editing of which, was to him, for half a century, a labour of love. Of all the scientific journals I have encountered, it is the most varied and multifarious in its contents, and it was not edited by proxy. But the greatest proof of the broad-view which Jameson took of the territory rightfully belonging to natural history, is to be found in the museum he collected at Edinburgh, where it remains a memorial of him, and is every day receiving additions.<sup>7</sup>

---

<sup>7</sup> Wilson and Geikie (1861), 110.



In his time it is true that other keen Wernerians saw Jameson as a theoretical 'leader' because of his theoretical beliefs, but they clearly demonstrate, too, that they were more smitten about the theoretical part of Werner's ideas than was Jameson himself. Contemporaries, most notably Ami Boué, wrote to Jameson's nephew in 1854:

Your uncle certainly has all the rights to such an honour conferred upon him, his services for science are cosmopolite for his pupils are dispersed over the whole earth's surface, besides that he was the electrical spark which induces especially the beginning of true geognosy in great Britain. The fightings of his Wernerian School with the Huttonian army was a true benefit for science, the unqualified Huttonians were shot down and only the best remained. If many fine fellows of the Wernerian troops did follow also, Professor Jameson remained and could lastly shake friendly the hands of his former enemies. When his mineralogical works are well known the high knowledge he had in various branches of Natural History is less known notwithstanding he insulated the taste for that branch of knowledge to so many clergymen, medical and scientific men of classes of society.<sup>8</sup>



Figure 13. 'Old Dr Jameson at the Geological Section of the British Association' Sketch by James Naysmith, 1850. NLS MS 3242 f68 no 157. Printed by Permission of the National Library of Scotland.

There is no doubt that Jameson extended knowledge of geology to such people and that his work needs to be understood as part of that wider social engagement within the earth sciences. I hope to have claimed here that geology's story, or the promotion of geology as a civic enterprise in early nineteenth-century Scotland, owes much to his

endeavours, to his international reputation as Professor of Natural History in the University of Edinburgh; as geologist; as zoologist and botanist; keeper of the Museum of Natural History; sole president of his own scientific society<sup>9</sup> and editor of his own scientific journal.<sup>10</sup> But what of the role of Wernerian theory in his geology? It is apparent that it changed over time in Jameson's mind.

### 8.2.1 Jameson and Geological Theory

I have shown in the introduction to this thesis that others to date have not examined Jameson's geology fully through his methodology, and in so doing, have subsequently only told the story of geological debate in triumphalist terms. Attributing to Jameson the label and reputation of hidebound Wernerian theorist has led to a distortion of events, the outcome of which has been to show Jameson to be the 'loser'. Whilst I have shown throughout this thesis that Jameson's theoretical side has been overplayed, when it is considered as but one part of his overall endeavours, it is important to note that Jameson was indeed, an adherent of the Wernerian theory and that his attitude concerning all aspects of it (both stratigraphical and those concerning the origin of rocks and veins) changed over time. Yet by the end of his life, it is clear that Jameson came to accept some, if not most, of those Huttonian tenets which he had so clearly resisted before 1817.

Due consideration here shall be given as to the exact nature of this position and that despite insurmountable evidence that shows Jameson to recant, it should not be presented whiggishly, as someone whose reputation was 'vindicated' by seeing the error of his ways but, contextually, as a consequence of inductive approaches which changed in relation to the accumulated empirical evidence gathered.

We must therefore be careful of others' earlier views. Typical of the Whiggish approach I hope to have exposed here was Archibald Geikie's interpretation of events.

---

<sup>8</sup> EUSC Gen. 1999 Ami Boué to Laurence Jameson, Vienna, 23 April 1854.

<sup>9</sup> *The Wernerian Natural History Society* See chapter two.

<sup>10</sup> *'The Edinburgh Philosophical Journal'*. See chapter Seven.

This not only presented Jameson in a 'loser' frame of interpretation, but, in doing so, suggested him to be gallant in defeat. He wrote:

Jameson and his band of co-believers in Werner came to be gradually isolated on the rocks of Edinburgh with an ever rising flood of the dominant geology around them. There they stood, battling as they might with the inevitable, until at last Jameson frankly acknowledged at one of the evening discussions of the Royal Society, that Wernerianism was doomed and deserved to die.<sup>11</sup>

Eyles, whilst using less antagonistic triumphalist language and correctly presenting Jameson as 'adherent' and not, 'leader' of a 'band of co-believers', also tends to the Whiggish in his account:

Although Jameson adhered to Wernerian views for many years, it is pleasant to be able to record that ultimately he accepted those teachings of the Huttonians that had stood the test of time. An anonymous biographer relates that he made known his change of opinion "particularly in different meetings of the Royal Society [of Edinburgh] with perfect candour and love of truth".<sup>12</sup>

Of the nature of the conversion itself, there still remains no direct evidence in Jameson's own hand that specifically expresses this opinion and so is difficult to date. The evidence of a change comes about more through Jameson's activities, and which has been discussed in chapter three through his teaching and in formal changes to his course syllabus after 1835. Here we see the incorporation of the very words 'Neptunist' and 'Plutonist' and of consideration to Huttonian and Wernerian theories of the earth.<sup>13</sup> This suggests that Leonard Horner seems to have been wrong to claim in 1847 that "in 1819 the system of Werner was [still] exclusively taught by Jameson".

Written testimonies also provide evidence of change. Jessie Sweet suggests that Jameson's 'conversion' was announced at a meeting of the RSE where he was meant to have recanted publicly.<sup>14</sup> Roderick Murchison, (1839) in the *Silurian System* says, "once convinced of the igneous origin of trap, he [Jameson] joined issue with his former opponents and has now become one of the most efficient expounders of that theory".<sup>15</sup>

---

<sup>11</sup> Geikie A (1875), 108.

<sup>12</sup> In Eyles (1954), 158.

<sup>13</sup> For a note of the changes made in this regard, see footnote in appendix 3. An exact date as to the formal introduction of these changes is unknown. The syllabus (version 3) in appendix 3 is known to postdate 1835. Changes could have taken place anytime after this and with certainty after 1841.

<sup>14</sup> Sweet (1967a), 216.

<sup>15</sup> Murchison (1839), 74.

Fitton, in a review of Lyell's *Elements* says: "Professor Jameson had delivered lectures on the system of Werner, for some years, we believe, before the appearance of this volume [*Elements of Geognosy* 1808]. He has long since expressed his conversion to the Huttonian theory with the utmost frankness, and, on several occasions, given the weight of his testimony to the genius of the author".<sup>16</sup> Ami Boué was also quoted in 1817 as saying, "did you know that Jameson has said this session publicly in his lectures that some basaltic rocks were undoubtedly of volcanic origin?"

A most noticeable public statement of this change was recognised in a chart that was published in the *Edinburgh Philosophical Journal* in 1822 and called the 'Geological Thermometer Shewing the opinions Attributed to Various Geologists with respect to the Origin of Rocks'. The scale confirmed a shift in Jameson's position on igneous rocks between 1808 and 1819. Labelled on a scale from 1-100 with the most Plutonic region at 100 and the most Neptunian at 0, Jameson's *Geognosy* (1808) is placed at 20 whereas an article in the *Edinburgh New Philosophical Journal* of 1819 placed him at 25, showing him to be more Plutonist in character. This would complement changes made to his syllabus throughout that time. Hutton's *Theory of the Earth*, Playfair's *Illustrations*, Sir James Hall's *Whinstone and Lava Experiments*, and Sir George Mackenzie's *Travels in Iceland* all ranked between 85 and 90 on the scale. As editor of this journal Jameson clearly had no problem with the publication of this "Thermometer".

Many utterances, although not directly confessional but that purport to a change of opinion, also come from Jameson's publications. In his preface to the fifth edition of Cuvier's *Theory of the Earth* he mentions Hutton favourably again as he does in the minutes of Jameson's Society. In 1827 Jameson removed the section on primitive rocks from his latest edition of Cuvier's translation. In 1820, Jameson wrote of the "true volcanic-neptunian rocks". In 1826, Jameson may have still been supporting the Wernerian origin of veins from below but equally in 1826 he could also mention "trap rocks, such as basalt...as intimations of older volcanic action".

In his later years, Jameson also intimated to not liking his own earlier work, especially his most theoretically driven-piece, *Elements of Geognosy* (1808). When Sir A. C.

Ramsay wrote to him to ask questions about the Wernerian school for a lecture he was preparing, Jameson's reply in April 1849 suggests that he was not by then lauding the illustrious Werner:

Dear Sir, accept my best thanks for the copy of the 'passages in the history of geology' which I have read with pleasure. Dr Macdonald who delivered the passage to me said you wished to know if I had written anything in your next lecture in regard to Werner and Co...I really do not recollect at the moment much on the subject but possibly it may be worth your while to look into a very old book, one I published in the year 1808. Its title is 'elements of geognosy' being the 3<sup>rd</sup> volume of one of the editions of my system of mineralogy... It is not very correctly printed but will shew that the Wernerian school was not indifferent to the importance of fossil organic remains – other papers I sent and were published without name so far. My imperfect account of Dumfriesshire may also be considered an illustration of the Wernerian geognosy, Yours Faithfully R Jameson.<sup>17</sup>

Jameson is here presented as someone who upheld theoretical beliefs by simply accepting the rising tide of insurmountable evidence, as seen to him, to be written in nature itself. Thus, to present him as a recanter is correct. To show him to be a defeated loser, is not.

### 8.3 Conclusion

There is a lot more to know about Robert Jameson. Given word restrictions in this thesis, I have only been able to consider his early geological activity. As a man of science with eclectic tastes and no desire for specialism, apart from mineralogy, Jameson's interests in natural history, zoology, botany, palaeontology, and geography, reveal themselves through lengthy publications<sup>18</sup> but I have not considered them in detail here.<sup>19</sup>

Whilst I have presented my arguments on his geology in as much detail as possible, it is fair to suggest that the role of geological theory in Jameson's scientific thinking remains complex. I have been able to assert wherever possible through a study of his actions in specific locations, and in relation to his methods. I have been able to

---

<sup>16</sup> Fitton, *Ed Rev* July 1839, 455fn.

<sup>17</sup> EUSC Gen 1999/1/12. Letter to Sir A C. Ramsay from Robert Jameson 28 April 1849.

<sup>18</sup> See appendix 4, listing of Jameson's non-geological publications.

<sup>19</sup> Secord (1991), has spoken about Jameson as Lamarckian. Withers (1999), has given attention to Jameson's interests in geography through his connections with the editors of the *Edinburgh Journal of natural and Geographical Science*.

suggest that his devotion to Wernesian theory *per se* was not as absolute as has been previously suggested because it only formed one part of his overall scientific activity and should not be held to have defined his character in the ways as others have argued.<sup>20</sup>

---

<sup>20</sup> There is lengthy archive correspondence of Jameson's family letters and zoological and botanical interests as professor that I have simply not been able to incorporate here. For a full or universal picture, particularly relating to Jameson's scientific philosophy these aspects of his professorship must be addressed if a thorough understanding is to be properly achieved

# APPENDENDICES

## APPENDIX 1

### CATALOGUE OF ICELANDIC MINERALS COLLECTED BY SIR GEORGE MACKENZIE. IN *TRAVELS IN ICELAND*, 1811. NATIONAL LIBRARY OF SCOTLAND.

- A no1** Rock in the vicinity of Reykjavik. Its colour is ash grey; it has rough uneven fracture and the fragments have blunt irregular edges; it is not very compact and with difficulty scratches glass: it contains particles of olivine. There is much resemblance; I am informed between this rock and the clinkstone of Andernach on the Rhine, where it is said to alternate with pumice. As some specimens contain a minute portion of hornblende and the rock appears to be principally composed of compact feldspar, it might be considered a variety of greenstone. It is however a lava. (Page 389).
- a2,a,a'** On examining these specimens, which are from the lower part of the same bed of rock; they all bear the most unequivocal marks of fusion. This is the case on the whole of the lower surface; hence I conclude that this rock is a species of lava.
- A, 3** In this specimen which is broken from a columnar mass, the effects of decomposition are apparent and the olivine seems to have been destroyed.
- 4,5,6** Are from the bed of rock under a1. It seems to be the same, only it is entirely vesicular; the vesicles are partly filled with a reddish white decomposed matter, quite soft and friable. This bed may be readily distinguished by its columnar form, as exemplified in the last 2 specimens. Some of the specimens contain specks of a brilliant golden lustre, which are olivine's in an altered state. 7 wacke lying horizontally above a1, but visible only for a few yards.
- 8,9** The same with a4, 5,6 from a place where it appears mixed with clay, slags and other matter forming a tuffa.
- 10** Fryable white steatites, forming a tumulus near the Hot Springs in the neighbourhood of Reikiavik [sic]. It is also (11) found where the hot water bubbles up. This circumstance and the tumulus being hollow at the top, make it

- probable that the latter has been the site of a boiling spring, of a larger size than any which now exist at this place.
- 12 The seatite occurs reddish brown, and has in some places, recently deposited matter adhering to it, some of which (13,14) effervesces with acid, though not all. Here (15) is also found tuffa the same as a9. 16 greenstone containing splendid crystals of feldspar from the island of Vidoe.
  - 17 Fine grained basalt, having a conchoidal fracture from vein cutting the greenstone. It contains small vesicles, some of which had water in them.
  - 18 This specimen shows a peculiarity common to all the veins we saw in Iceland; a vitreous coating we saw on the sides which becomes gradually blended with the substance of the stone.
  - 19,20 Columnar greenstone from the same place. The latter contains small specks of a black vitreous substance the fracture of which is conchoidal. The same has been observed by professor Jameson in the trap rocks of Fifeshire and by Mr Allan in the western parts of Midlothian.
  - 21 From a vein of vesicular greenstone cuts a mass of trap tuff\* (I use the term tuff here, because this rock is similar to the trap tuff of Werner).
  - 22 A slaggy mass from the tuff
  - 23 Mass of vesicular greenstone from the same; many of the vesicles coated with zeolite.
  - 24 This rock may be considered as non-descript. It is composed principally of the brilliant black substance, small specks of which were observed in a20; but here it occurs in larger masses mixed with a dull blackish green matrix which circumstance denotes it to be a tuff (25) it contains masses of amygdaloid and nodules of pyrite (a'1) some of which have small quantities of pitchcoal adhering to them. Professor Jameson informed me that he observed a rock in Dumfriesshire which (h) resembles this. The black substance seems to be pearlstone and the rock may therefore be called pearlstone tuff. This rock appears irregularly connected to greenstone. There is in the island of Vidoe a rock of fragmented amygdaloid which in some places appears divided into large (p4) masses by a sort of network of veins; the substance (no26) is similar to no 24. Columns of vesicular greenstone are seen resting on it.
  - 27 A great portion of the island of Vidoe consists of a1 in a 27 there are specks of olivin [sic], of a brilliant blue colour, in a state of decomposition. In one place we observed a vein of greenstone about forty feet thick, in such a situation that it must have cut a27 though we did not see the junction of the rocks; several yards between the beds on each side and the vein, being covered with soil.
  - 28 From columnar greenstone near the above-mentioned vein.



- 29 Columnar greenstone; the columns being composed of tables from 3 to six inches thick and from 3 to five inches in diameter from one of which a29 was broken.
- 30,31 From a vein of basaltic tuff cutting greenstone.
- 32 Broken from the wall of a rent in greenstone, which appeared to have once been filled with matter forming a vein. This mass has a curious reniform appearance and the vitreous coating mentioned as being common to the veins of Iceland.
- 33 From the same place, tinged green by some metallic substance.
- 34 Another from the same place, having a vitreous metallic glaze on its surface.
- 35 The rock from which this specimen was taken is on the mainland opposite to Vidoe. It has on the great scale an external appearance from which one might be led to think that it has a slaty structure; but this seemed to be owing to decomposition. It is I (p5) fine-grained greenstone and it passes into the columnar form the columns being horizontal. Near the place where this was observed, we saw diverging columns of amygdaloid resting on vertical columns of greenstone. We could not discover any connection of a1 and a5 with this greenstone.
- 36 Tuffa found a few miles to the south of Reikiavik [sic] on the seashore. It contains masses of greenstone, basalt, amygdaloid, small specks of the substance forming so large a proportion of a24 (black pearlstone?) of a1 and a5.
- 37 Under the tuffa is a bed of wacke, containing shells in some places 4 or 5 feet thick. This was traversed by a vast number of cracks on each side of which at right angles with them, were innumerable (38) minute columnar masses of which a38 is a specimen.
- 39 From an included mass in the tuffa
- 40 Appears to be wacke, much indurated.
- 41 Under these we observed a1 and also a rock the same as a24.
- 42 Are a specimen of the tuffa, with the wacke adhering to it.
- 43 Is part of a large mass of columnar greenstone contained in a rock similar to a41, which we saw on the sea shore in going to Havnefjiorð?
- 44,45 Specimens of the lava near Havnefjiorð. This lava is of a bluish grey colour, dense and vesicular. It contains crystals of feldspar and had olivin [sic] disseminated through it. In several parts of this stream of lava, we observed that the olivin [sic] from decomposition or alteration presented a beautiful iridescent appearance.

- 47(p6) At the extremity of the lava towards the west, on the shore of the bay, we found a considerable extent of rock similar to a1. We did not see the junction of this with any other rock but we soon came to a tuffa with a vein of the same rock passing through it (48). The sides of this vein have a vitreous appearance already mentioned (49). A little beyond this vein a large extent (50,51) of tuffa occurs, with the same rock passing through it in many directions that the two seemed as if mixed together. The tuffa has here a paste similar to a9 inclosing round, black vitreous masses like obsidian, perhaps black pearlstone.
- 52 A specimen of this has part of a vein adhering to it, presenting an appearance, which many will consider being the effect of heat and which strikes me as such. Above these we found a1. Not far from this place is some Hot Springs, which are covered by the sea at high water.
- 53,54 Are specimens from the cave, mentioned p 108 of the (55,56) journal. The first three are from the roof, 56 is from the bottom and 57 is part of a mass which appeared to have been squeezed, while soft from the side.
- 58 Are from one of the little craters, mentioned in the same part of the journal.
- 59 Is a specimen of tuffa, of which whole ranges of mountains are composed in the guldbringe syssel.
- 60 Soft white clay, from a bank on the side of a mountain on the road to Krusavik. It has evidently been (p7) produced in the same manner as the banks on the sulphur mountains, which are not far distant.
- 61,62 Masses from the same place; the first 2 are (63) depositions the last is an altered rock. The specimens of sulphur are deposited in this part of the collection but are not marked as the count of their delicacy.
- 64,65 A rock above the sulphur banks; it appears to be a tuffa in a state of decomposition and very friable.
- 65 Similar to the last, but not so much decomposed; from the same place. It may perhaps be variety of a24 from the appearance of specks of pearlstone.
- 66 Porhry slate, from the same place.
- 67 We observed a great quantity of the rock a63 appearing above the surface of the clay and sulphur. It is difficult to give it a name. It is composed of soft roundish masses about the size of a walnut of a greyish yellow colour, separated by iridescent ferringous films; and is extremely fragile. It has evidently been altered and is probably wacke. It has too some resemblance of seatitite. The specimens of sulphate are of lime which are arranged in their part of the collection are not marked. They were taken from different places where masses occurred irregularly projecting through the clay. They are very beautiful; chiefly white, tinged with red; and are confusedly crystallised, some of them fibrous and some of them stellated.

- 68 From the submarine lava's from the coast near Krusavik. It greatly resembles porphyry slate and the specimen above marked b.
- 69 Lava between Krisuvik and Grundevik
- 70,71 Specimens of the pumice and slag which were washed on shore during the marine eruption of 1783.
- 72,73 Specimens of lava from Grundavik containing feldspar and olivin [sic] the latter irredesant.
- 74,75 Varieties of a1. The first was found on the road from grundavik to kieblivik, where ubterraneous heat had acted in tremendous manner; the two last near Keiblavik in beds.
- 77 Part of an amygdaloidal vein, near Brautarholt. It seems to be a variety of basalt. Its colour is dark and bluish grey. The fracture is imperfect and concoidal passing into uneven. It is difficulty frangible; and the fragments have very sharp edges. It may be scraped by a knife, but it scratches glass easily. It is very compact and on the whole greatly resembles indurated clay. Beside calcareous spar and common radiated zeolite, it contains nodules for the most part long and cylindrical or rather of the shape of an egg much elongated and sometimes flattened. These nodules are lined with laumonite a variety of zeolite lately described the crystal of which are characterised by their extreme brittleness; so much so that we could not preserve a single entire specimen. The outside of the nodules was coated with green earth.
- 77b Part of one of the largest nodules.
- 78 Vesicular slaty clinkstone through which the former passed. (79) It likewise appeared to traverse greenstone which also had a slaty structure and contained much green earth. The mountain of Essian and those which belong to the same range are composed of varieties of p9 greenstone and amygdaloid, traversed by veins of basalt such as have been described and of (80) jasper of various colours. The veins have the vitreous coating on their sides.
- 81 The jasper is often mixed with calcareous spar and passes sometimes in to opal jasper.
- 82 A specimen taken from the centre of a vein; it is much less compact than the jasper and appears to have been included portion of some other rock in an altered state. Sometimes the jasper (83) from decomposition is vesicular.
- 84, 85 Are varieties of jasper. The last specimen is interesting in so far as it shows the jasper passing into opal jasper and from that into pitchstone.
- 87 Amygdaloid containing agate.

88, 89 These two specimens are particularly deserving of notice, esp. the last. a88 is an amygdaloid containing calcareous spar in elongated vesicles. I do not wish to lay any particular stress upon this specimen because it has been unfortunately damaged and because certain appearances which it presents may be attributed to the effects of the weather. But as it was found along with the next specimen, I may state what strikes me in regard to it in order to induce future travellers to attend particularly to the spot where these were found which is in the e face of rock on the shore of Havalfiord, before turning into the valley on the road to Houls. Several days might be spent in this district. The spar in a88 is not attached closely to the sides or bottom of the vesicles, which are lined with a number of minute round yellowish coloured masses which have left impressions on the spar (10) these are also seen in the body of the stone and must have lined the vesicles before the spar was formed. If the spar entered in a state of solution it ought to have reached the bottom of the vesicles and adhered closely to the sides. If any empty space was left at all, it should have been in the heart of the spar itself but a89 which was found at the same place exhibits marks of fusion which cannot be mistaken. I may here mention that among the debris of the rocks in this place, great quantities and varieties of slag's were observed but these did not at first excite particular attention as we were at the time quite ignorant of whence they came. Nor did take particular notice of the specimen under consideration excepting as a slag till I was repacking it to be sent home. This remarkable specimen contains calcareous spar, and is one, which, together with others to be soon described gave rise to the discussion in the chapter on mineralogy at this place there are fine calcedonies and zeolites. The rocks near Houls consist (90,91) of apparently horizontal beds of amygdaloid, porphyry slate and (92,93) blackish pitchstone. Beyond this place masses of (94,95) porphyritic pitchstone of a dull black colour were found and also a species of tuffa and a variety of wacke in a state of decomposition. On the western side of Havalfiord, nothing particular occurred, all the rocks being greenstone or amygdaloid, excepting a variety of the former (98) of an ash grey colour. The following specimens illustrate the colour of the mountain of Akkrefell and probably of almost (p11) all the mountains in this part of Iceland. It was with difficulty and hazard that we obtained so complete a series of specimens, which are peculiarly interesting as proving the existence of a new set of rocks in the structure of the crust of the earth.

## P11 section B

All the mountains in this part of Iceland. Was with difficult and hazard that we obtained so complete a series of specimens which are peculiarly interesting as proving the existence of a new set of rocks in the structure of the crust of the earth.

1 tuffa which appears (2,3) on the shore near Indreholm. 4,5 amygdaloidal greenstone containing fine crystals of chabsie or cubic zeolite on the shore above the former. 6 another tuffa, which formed the lowest visible bed of the mountain. It is similar to what is found in the gulled bringe syssel but no lava nor slags were observed in it. It contains cavities lined with minute crystals, unconnected with any included masses.

### 7.8.9 Amygdaloid from 3 different beds.

- 10 This fossil is very similar to red sandstone but is in fact a fine-grained tuffa. The mass of it, which we saw, was not more than a foot thick and was irregularly, interposed between the beds.
- 11- 16 Varieties of amygdaloid from different beds. The next specimen is wanting in the series, on account of the package having got wet and the number having been lost.
- 18- 22 Varieties of amygdaloid follow.
- 23 Are similar to b10 and, being coarser serves to elucidate the nature of that substance. Above, (25) amygdaloid appears again. One variety of it appears vesicular some of the vesicles being empty and others filled with chabazite the crystals of which in one instance assume a stalactite disposition.
- No1. After experiencing great difficulty we arrived at a (p12) bed the lower part of which was slaggy. Under some (no 2) of the slags was a substance, apparently indurated lithomarga of the same red colour as that which forms so prominent a feature in the aspect of the giants causeway, and which abounds in the many parts of the county of Antrim.
- 3 This specimen shows the junction of the slag with the rock.
- 4 The rock itself which resembles the lava of Havnefiord (a44,45)
- 5 Above this we found amygdaloid, an unexpected occurrence in this situation, but we afterwards found it again in another part of the same mountain, the amygdaloid been placed between two beds the lower (678) of which were slaggy.
- 9 From a vein of basalt which cut the beds nearly in a perpendicular direction.
- 10 Part of the edge of the vein, vitreous at the sides. Above this, to the top of the mountain, all the bed, except those of tuffa were slaggy on the lower surface.
- 11,12 Some were amygdaloidal as 11, and others compact (13) as 12 and some were vesicular and scorified looking throughout as 13. One of the beds of tuffa was very large, not less than 50 feet thick and contained slags and lava. Many of the included masses were several feet in diameter. The average thickness of the beds composing this remarkable mountain I suppose to be about 20 feet. Above this great bed of tuffa were several beds slaggy underneath the uppermost resembles the Havenfiord lava (15). This singular assemblage of rocks which I have (p13) endeavoured to show to be a series of lavas erupted at the sea, I believe will be found to extend over the whole of Iceland and it is very probable that the future researches of geologists will prove that the whole island has been produced by the agency of heat; the power and efficacy of which seems to be vastly under

rated by many philosophers who have not seen or sufficiently considered its effects.

No26 Deposition of the hot springs near leira.

27 Conglomerate formed by the deposition of the same springs.

28,29, Silecous, petrifications, apparently of peat, containing (30,31) roots from the same place. These have been formed from more ancient peaks, which no longer exist. In passing over the eastern Skardsheide the same rocks, we had already observed occurred and among them pitchstone. In the vast precipices which were everywhere exposed to view we saw the finest possible display of the structure of the mountains and recognised the tuffa, so often mentioned at a great elevation. Zeolites and calcedonies were scattered about in abundance but we did not see any that were remarkably fine. The rocks of the western Skardsheide, continued amygdaloidal, till we met with lava of the same nature as that of Havnefiord (32). Hills of tuffa were on every side. Leaving the defile which was filled with lava, nothing particular occurred until we were met with a greenstone very highly crystallised, partly amygdaloidal and (33,34) partly porphyritic. The crystals of feldspar occurred more than half an inch thick. Beyond the valley (p14) of Stadahraun, which was full of lava, the mountains consisted of the same minerals as those we had left behind; and contained great plenty of zeolites of every description. I found one remarkably fine specimen, half of which I placed in the cabinet of Mr Allan, and the remainder in that of the college of this city. It was found entire among the debris and was afterwards broken when it displayed most beautiful cavity.

35 A specimen of the amygdaloidal rock containing stillbite.

36. Lava from Roudimelr. It contains a great quantity of augit and altered olivin [sic].

37. A specimen of the range of columns near that place. This rock does not differ, except in this being more compact from the lava of Havnefiord and other places.

38 Part of a rolled mass sienitic greenstone, the feldspar white.

39, 40. Depositions from the spring at Lysiehouls chiefly (41) calcareous. Not far from this spring are large quantities (42 43) several acres, of petrification's that have been formed by some ancient springs which held silica in solution.

45 Lava of buderstad, which differs from that of havenfiord in containing augit.

46 From the columns at stappen. Here there is still a resemblance to lava, only this contains less olivin [sic] than the laves we had met with before.

47 (p15) From the lower end of a column. Wherever we saw the (48 49) lower ends they were slaggy. Slags were found in the heart of some (50) and lining every

cavity we observed. The specimens can hardly leave a doubt of the action of heat.

- 51 52 From a stream of lava that has flowed from Snaefelljokull (53 54) the more compact specimens are exactly similar to black basalt. In several parts of this stream we saw we saw masses very different from the lava in general (55). They contain a few minute vesicles, one very small crystals of feldspar and specks of augit. The general colour of the stone is ash grey, spotted with white and it appears to have a slaty texture.
- 56 A specimen of pumice, picked up from among many that still remain of those heaps which were washed away during the eruption in 1783. Masses of pumice exactly similar to this have been frequently found on the north coast of Ireland and in all probability were derived from the same source having floated on the surface of the ocean from the place where the marine eruption took place.
- 57 58 Slags, pumice and obsidian from the Snaefelljokull. these were picked up by friends (59 60) from a bank composed of them (61) and which was free from snow.
- 62 63 Specimens from a bed on the mountain between stappen and Olafsvik. The upper part of this bed (b62) is a perfect greenstone, containing small specks of olivin, augit and feldspar. The middle part of the bed (63) has a corse and scorified appearance and the lower part (63) is completely slaggy. (65) From another bed on the same road. It contains the largest masses of augit we had observed. I should have remarked that w did not see any augit distinctly crystallised.
- 66 Part of a rock which is heaved up into blisters like (p16) those near Reikavik [sic]. It is very like a1 but is more generally vesicular.
- 67 Tuffa on which a grand range of columns on the road to Olafsvik rested. (68) Is part of one of the columns which differ from those at stappen in being more compact. (69) From a large rolled mass in the river near the columns. It is a highly crystallised greenstone containing augit and large crystals of feldspar. The rocks about Olafsvik are amygdaloidal and in several places beds of tuffa present themselves. The most curious appearance in this neighbourhood is a vein of slaggy matter passing through the bank of gravel which forms the beach. On a point of land several miles to the east of Olafsvik are some fine range of columns overhanging the sea. Some of these appear as if they had been twisted. At the only place where they were accessible they presented an undulated appearance on the lower ends at the separation of the columns (71) from a bed of amygdaloid on which they rested; but of this it was difficult to obtain specimens. When broken the fracture exhibits (72) the vitreous appearance so often observed on the sides of veins (73). In some places the same slaggy appearance is seen on the sides and also in the very heart of the columns. Specimen of greenstone from a mass that had fallen from a precipice not far from bulndshofde. Another mass from the same place. It is of an ash grey colour, vesicular, the vesicles being irregularly shaped and lined with minute

transparent crystals (17) some of the vesicles contained minute diverging crystals of calcareous spar. Near a cascade mentioned (78) in the journal p186 we observed numerous veins of (79 80) greenstone passing through the rock of the same substance tuffa and amygdaloid all in the greatest confusion. In this part of the country tuffa frequently occurs and when it forms the top of mountains, it is easily recognised by the rugged and fantastic peaks which they present similar to those in the view of the view of the sulphur mountains. At Stikkesholm I observed a vein of greenstone standing erect like a wall about the height of ten feet, the beds on each side having been worn away, the sides as usual were vitreous (82). It contained nodules of obsidian.

- 83 Shows both sides of a vein containing small nodules of the same substance. a vein of calcareous spar traverses the rock in various directions; from one of which I took a specimen of seem opal (84).
- 85 Is a specimen of highly crystallised greenstone which is disseminated through part of the rock near this place.
- 86 Mineralised wood from drapuhlid.
- 87 Ash grey pearlstone from the same mountain.
- 88 89 Greensish black pearlstone from the same.
- 90 91 This rock was immediately above the preceding
- 92 93 Above the last. This rock greatly resembles some we observed near houls where it was connected with pitchstone. The colour is dark bluish grey with round reddish white specks. The fracture is uneven and earthy and is somewhat slaty in the texture. (p18) 94 this appears to be the same rock, entirely slaty with the specks hardly visible; the beds were horizontal these two rocks are similar to the fossils which accompany some of the pitchstone veins in the island of Arran.
- 95 From a vein of pearlstone at the base of the mountain at baula, on the west side. The colour is greensish grey. This has much of the character of pearlstone.
- 96 Dark green pitchstone from the same place.
- 97 Pitchstone porphyry from the same place.
- 98 This is from a rock connected with the pitchstone veins of baula probably a variety of porphyry slate.
- 99 100 Small masses of coaly matter which were given to me as having been found on the mountain of Baula. Both have a strong resemblance to wood but are different from that of drapulid. They contain a small quantity of pyrites and burn with flame.



## Section C

- 1 This tuffa was found at Eyalstadir, and is the same with b10 from the mountain at Akkrefell. It is here connected in the same manner with submarine lava.
- 2 The under-surface of a bed of amygdaloid resting on tuffa which has the peculiar characters of a slag. The bottom of this bed is not exposed in many places being concealed by debris. It is probable that in the course of the thoirosa, in places higher up some interesting examples of submarine lava may be seen.
- 3 The upper part of the rock containing analcime.
- 4 The same with green stactite.
- 5 Black obsidian. (p19) this occurs only in detached masses at the same place where the specimen is found. It exists in great quantity in the neighbourhood of mount krabla from whence, I was informed all the specimens of Icelandic agate in the European cabinets were brought. This is not so perfectly vitreous as specimens I have seen in the north of Iceland.
- 6 The most common variety in the great stream which we saw. It is vesicular with white crystals of feldspar scattered through the mass.
- 7 In this the vesicles are elongated and flattened so much that when viewed in one direction it seems as if composed of plates. The other fractures show distinctly the vesicular structure. The crystals of feldspar are nearly disengedd I have seen many similar specimens from lipari.
- 8 Contains more feldspar ; the vesicles are minute; and it approaches to pumice.
- 9 10 Show the whole gradation from compact obsidian to the most perfect pumice
- 11 This contains feldspar, and is blackish grey. it wants the vitreous lusture and its fracture is uneven it is dense and somewhat vesicular. This and the following have been called compact pearlstone by Mr Jameson.
- 12 The vesicles of this are studded with minute globular white and hard masses. It is of an ash grey colour and passes into obsidian (13). One variety has a peculiar aspect; appearing when fresh broken as if dusted over with a purplish grey powder.
- 14 These are seen in different specimens passing into obsidian (15 16) which appears in layers. One specimen (c14) exhibits small globular masses of a reddish grey colour, dispersed through the obsidian.
- 17 In this specimen all these are connected as well as the gradation into pumice.

- 18 19 These specimens have masses of slag attached to them. Pumice occurs above the obsidian and from the motion of the stream when flowing has been sometimes included in it.
- 20 This is a remarkable and beautiful specimen the last of the series of a stream of obsidian. It is a mass of slag, in a cavity in which some fusible matter has been included and reduced to the state of glass. The cavity is lined by it in stalactitic masses and some of the matter has been drawn out to the fineness of hair. No operation of water could possibly produce these appearances.
- 22 Are specimens of lava from Mt Hekla which are very like those from Snaefelljokull.

*b51 &c.*

The remaining numbers to c40 inclusive are varieties of slags from Hekla c33 34 being from the very summit of that celebrated mountain.

- 39 Is the only mass we found having the appearance of an ejected stone, it is little altered and is probably sienite.
- 40 Is a specimen from the hills of tuffa which surround Hekla. The specimens from the geysers are marked from d1 to d41. As the productions of the hot springs in Iceland are of a nature entirely different from those of any other springs in the known world, it is probably not presuming too much when I propose to mineralogists, to form a separate class of those minerals which have been deposited from chemical solution in water (p21) under the general name of hydloite and to arrange the stony depositions of water under the heads of calcareous and siliceous hyrdrolite. This is perhaps a more precise denomination than sinter the word used by Werner and at once conveys the known mode of the formation of such substances. I propose to draw up a minute description of the depositions of the hot springs of Iceland and to obtain the assistance of chemical analysis that it may be known whether composition has any influence in the variety of external appearance. In the mean time I throw out this hint for a new arrangement of the depositions of water that I may discover whether it is likely to obtain the approbation of mineralogists. I shall therefore, at present only point out the specimens in a very general manner. d 1 to 5 the outer part of the mount 1 2 being the surface and much resembling the heads of cauliflower's 6 7 from the inside of the basin. This takes a tolerable polish and is very pretty.
- 8 Is a mass of old incrustation coated over with recently deposited matter. It was taken from a hollow on the mount in which the water was retained.
- 9 Is part of the depositions of the new geyser formed apparently when that fountain presented phenomena different from what it now does.
- 10 11 From the beautiful cavity described p214 the specimens resemble the capital of a gothic column.

- 13 Is from the same place.
- 14 A mass of turf on which the water after having cooled was depositing its contents while the grass was yet growing. (p22) 15 to 18 masses of petrified leaves &c.
- 19 This was picked up among the ld incrustations. the opaline matter is arranged in waved lines which are separated by layers of an open texture, resembling the tables of the skull separated by cellular bone.
- 20 Contains leaves and rushes and is discoloured by iron.
- 21 22 Masses of petrified heat containing rushes as branches
- 23 Clay from the muddy springs
- 24 Shows the oppailne matter in layers
- 25 Appears to have been produced by the deposition having taken place upon a conferva to d37 varieties of depositions and petrification's.
- 38 39 From the spring to the northward of the geysers. it bears a very striking resemblance to opal.
- 40 A curious specimen picked up on the clay bank above the great geysir. it is in a state of decomposition and is a good model of a rocky promontory. I am told that it is not unlike that of fairhead in Ireland.

## APPENDIX 2

### PETROLOGICAL DATA OF SIR GEORGE MACKENZIE'S ICELANDIC SPECIMENS, R368-R375. AFTER M. PEACOCK, 1925.

R368 and R369 which Mackenzie describes as "the most common variety in the great stream which we saw." There specimens are black phyric obsidians charged with felspar phenocrysts, which reach a size of 4mm. Microscopically the crystalline constituents agree with those of the rock just described. The felspars are again dominantly sodic, and probably contain varying amounts of the orthoclase molecule; rounded outlines due to magmatic resorption are more frequent than straight edges, and inconstant chemical composition is indicated by uneven extinction; a case was observed of a prism of albite with close-set lamellar twinning embedded in a larger, geometrically similar prism of untwinned potassic felspar; colourless or pale brown glass inclusions are plentiful. Pyroxene is again represented by the green sodic variety, ægirine-augite, while magnetite occurs exactly as in the previous rock. The groundmass of the obsidian is a perfect colourless glass of R.I.=1.497, containing many cavities which are much contorted, as would be expected in the flow of a viscid acid lava. The glass contains a second generation of felspars, which again are probably orthoclase. R371 differs from the above only in that the felspar phenocrysts are chiefly orthoclase, twinning being either absent or simple. R370 is a dull pitchstone representing an intermediate stage between the obsidian and the acid trachyte. In R372 the passage from obsidian to trachyte is seen in one specimen; the thin section taken from the trachyte shows as phenocrysts the same minerals as the previous examples; the groundmass, however, consists in this case of a rough meshwork of reddish, cryptocrystalline bands isolating smaller, perfectly glassy areas. Of R375 Mackenzie writes as follows (1811):- "This is a remarkable and beautiful specimen, and last of the series from the stream of obsidian. It is a mass of slag, in a cavity of which some fusible matter has been isolated, and reduced to the state of glass. The cavity has been lined by it in stalactitic masses, and some of the matter has been drawn out to the fineness of hair. *No operation of water could possibly produce these appearances.*" The slag referred to is basaltic, containing crystals of anorthite. It was obviously caught up by the obsidian flow, some of the molten material being trapped in a cavity in the slag; this liquid material then solidified in the act of dripping from the roof of the cavity, producing the stalactitic effect which Mackenzie noted. The hair-like material is missing from the specimen, but, as Mackenzie says, these glass threads could not possibly be explained by the Wernerian theory.

TABLE. ANALYSES OF ICELANDIC ACID ROCKS.

	I.	II.	E.	III.	F.	G.
SiO <sub>2</sub>	81.08	75.01	74.38	69.81	67.17	60.60
Al <sub>2</sub> O <sub>3</sub>	11.45	12.27	11.86	13.85	15.27	17.55
Fe <sub>2</sub> O <sub>3</sub>	n.d.	0.80	1.92	3.21	1.58	1.17
FeO	0.21	2.78	1.11	n.d.	2.41	6.08
MgO	Tr.	0.08	0.19	0.43	0.85	2.04
CaO	0.46	1.87	1.26	1.38	2.33	4.02
Na <sub>2</sub> O	2.30	3.36	4.62	5.56	6.20	3.97
K <sub>2</sub> O	3.64	2.80	3.56	4.40	3.09	2.73
H <sub>2</sub> O+	0.60	0.25	0.27	n.d.	0.63	Tr.
H <sub>2</sub> O-	n.d.	0.13	0.42	n.d.	0.08	0.20
TiO <sub>2</sub>	n.d.	0.33	0.32	1.06	0.29	0.92
P <sub>2</sub> O <sub>5</sub>	n.d.	0.02	0.09	n.d.	0.10	0.32
MnO	n.d.	0.06	0.10	n.d.	0.08	0.35
CO <sub>2</sub>	n.d.	n.d.	None	n.d.	None	None
	99.74	99.98 <sup>1</sup>	100.10	99.70	100.08	99.95

I. I. 3. 1 (2) 3. Liparite, *Berufordskard*, Iceland. C.W. Schmidt (1885), p. 776. Anal. C. W. Schmidt. Quoted in W.T.,<sup>2</sup> p. 63.

II. I. 3". 2. (3) 4. Obsidian, *Hrafastinnuhryggur*, Iceland. F.E. Wright (1915), p. 260. Anal. J.B. Fergusson. Quoted in W.T., p. 92.

E. I. "4. 1. "4. Rhyolite, *Baula, Myra Sysla*, Iceland. Anal. M.A. Peacock. Described in thin section on p.

III. Norm not determinable. Liparite, *Dómadalsbraun, Torfajökull*, Iceland. H. Bäckström (1891), p. 744. Anal. H. Bäckström. Quoted in W.T., p. 754.

F. I. (II). 4 (5). 1 (2). 4. Soda-trachyte, *Dómadalsbraun, Torfajökull*, Iceland. Anal. M.A. Peacock. Described in thin section

<sup>1</sup> Including CO<sub>2</sub> none; ZrO<sub>2</sub> none; SO<sub>3</sub> 0.07; Cl 0.13; F none; S 0.02; Cr<sub>2</sub>O<sub>3</sub> none; V<sub>2</sub>O<sub>3</sub> none; NiO none; BaO none; MnO<sub>3</sub> none.

<sup>2</sup> W.T. = Washington's Tables; see Washington, 1917.

APPENDIX

GEOLOGY  
JAMESON  
17, 71827-28, 1

Version 1.

Syllabus  
from the  
Dec 10, 1927-28, 1  
Natural  
University of

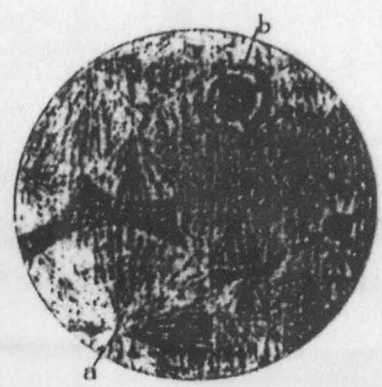
"Natural history  
hydrogeology"

Thirdly on

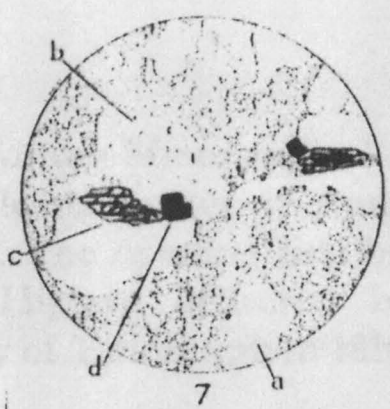
This science  
perhaps the  
doctrines or  
simple mineral  
can answer the  
which make of  
geography -  
mineralogy

Hydrogeology -  
mineralogy -

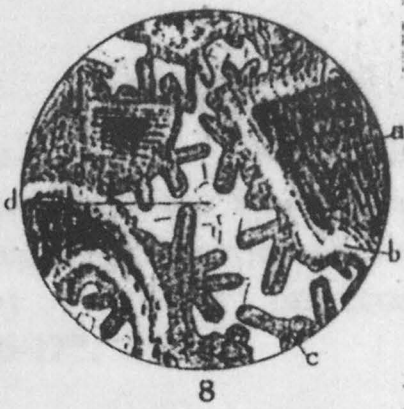
Geography -  
mineralogy -



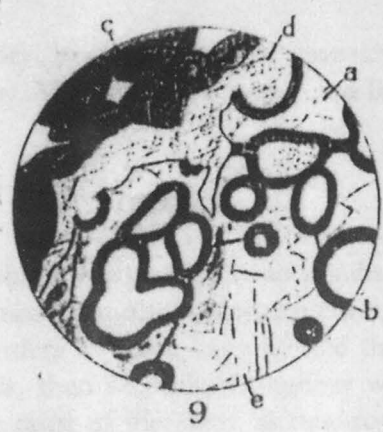
6



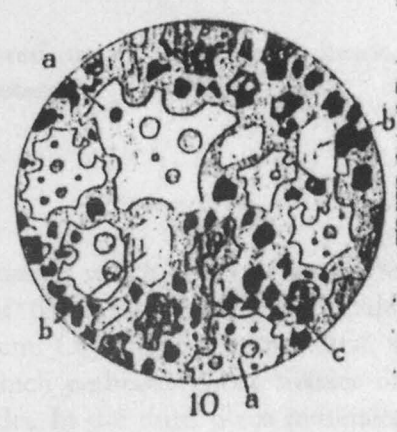
7



8



9



10

## APPENDIX 3

### GEOLOGY AND MINERALOGY SECTIONS OF ROBERT JAMESON'S CLASS SYLLABI FOR THE SESSIONS, 1816-17, ?1827-28, POST 1835 AND POST 1841.

#### Version 1.

Syllabus for the Mineralogical section of session 1816-17 taken from the lecture notes of student William Carruthers, (EUSC Dc 10.32). The opening title begins "Sketches of Lectures on Natural History delivered by Professor Jameson In the University of Edinburgh in 1816-17".

"Natural history has been usually considered under five grand heads, meteorology, hydrography. Mineralogy, zoology and Botany".

#### Thirdly of Mineralogy

This science which treats of the various substances which occur of the crust of the earth is perhaps the most important department of natural history. It is divided into several doctrines or orders as some have termed them. Oryctognosy stands first, which treats of simple minerals, then secondly Geognosy which embraces those masses of matter which can situate the crust of the earth, as new rocks. In the third place mineralogical chemistry which makes us acquainted with the various characters of minerals. Fourthly, mineralogical geography which explains to us the geographical situation of minerals, and lastly axonomical mineralogy which discusses the different relations and uses of minerals.

**Oryctognosy** – by this branch we ascertain the various characters of minerals. Earthy – saline – inflammable – metallic –

**Geognosy** – which treats of the mountain rocks and rocks from the crust of the earth. Crust of the earth – mountain masses – formations –

**Primitive rocks** Granite – gneiss – mica slate – clay slate – trap – serpentine – syenite – porphyry – topaz rock – quartz rock –

**Transition** – we now proceed to the transition class of mountain rocks. Graywacke – transition clay slate – hornblende – amygdaloid rock – limestone – porphyry – sienite – alum slate – sienite –

**We shall now give an account of the principal rocks of individual formations.**

Sandstone – limestone – gypsum – trap – coal –

### **Physiognomy [sic] of the Earth's surface**

We shall now give a short account of the theories of the earth of which these are the neptunian, the volcanic and plutonic. According to the first the earth's crust of dry land was formed from a state of solution; according to the second all other rocks are admitted to aquatic origin except the traps of which it considers volcanic productions. The third theory again ? the present solid points of the globe from the agency of fire.

From this short [?] we see that many of the Huttonian presentations have yet to proceed and many we know to be contrary to fact. ...and other singular appearances have occurred all equally contrary to the Huttonian speculation”.



## Version 2.

### Syllabus (possibly for 1827?) in EUSC X Coll. 623/21

“This course of lectures on Natural History embraces general and particular details and views on Meteorology, Hydrology, **Mineralogy**, **Geology**, Botany and Zoology. These subjects are discussed in the following order:-

### III Mineralogy

This branch of natural history, which makes us acquainted with the various natural and economical relations of simple minerals, is treated in the following manner:-

**Preparative Part of Mineralogy.** – explanation of the language of mineralogy – history and account of systems of mineralogy – descriptions of simple minerals – various uses of Simple Minerals in the Arts, Medicine, Agriculture and in the Economy of Nature..

### IV Geology

1 Account of physiogomy [sic] of the earth including descriptions of High Lands and Low lands, plains, Groups of mountains, chains of mountains, and single mountains, of the different kinds of valleys, of caves and caverns, and of the inequalities of the submarine land.

Account of the different kinds of structure observable in the solid mass of the earth.

3 On the materials of which mountain rocks are composed

4 Description of the different classes of mounatin rocks beginning with the deepest seated or oldest, and terminating with the uppermost or newest.

5 Description of the different classes of mountain rocks, their various natural relations and their use in the economy of nature and to mankind.

6 On veins, and as connected with this subject, details in regard to the distribution of metalliferous minerals.

7 The phenomena, effects and theory of volcanoes.

- 8 Description and arrangement of soils, or those loose superficial matters that cover the solid strata, and in which plants grow and many animals live.
- 9 Description and history of marshes, morasses and peat bogs.
- 10 On the connection of geology with agriculture and planting.
- 11 On fossil organic remains, their systematic arrangement, and description. Geognostical distribution as connected with the state of the earth during the different periods of its formation.
- 12 On the figure, density, magnitude, heat, electricity, and magnetism of the earth.
- 13 On the formation of mountains, valleys, caves and plains, in reference to the various phenomena exhibited by the earths physiogomy [sic].
- 14 Theory of the earth, as deduced from the facts and views in the previous part of the course.
- 15 On the deluge and age of the world
- 16 Account of planetary system.
- 17 On the earth as a member of the planetary system, comparison of its form, magnitude, surface, light, atmosphere and changes with those which have been observed in othre parts of the planetary system, especially in the moon and sun.
- 18 On the fixed stars as seen by the naked eye and the telescope; and on the various groupings and arrangement of these constituting the grand system of the universe. A...on the geognostical structure of Scotland England and Ireland. B. modes employed in searching for useful minerals. C mode of conducting mineral surveys of constructing geognostical sections and maps, and of modelling mountains, hills and plains.”

## Version 3

### Syllabus for Post 1835 (EUSC Gen 130. 2 copies)

(This version must post date 1835 owing to the mentioning of the Geological Term *Silurian*. By this time a marked change had occurred in the structure of the Syllabus, including the separation of Geology from the earlier section of mineralogy. There are two copies).

“This branch of natural history treats of the structure and composition of the solid mass of the earth, and also considers its modes of formation. The general cosmical properties of the globe, its connexion with the planetary system and that of the universe, are also considered. The following is the order of the lectures:-

1. Figure; density, Magnitude; temperature, electricity and magnetism of the earth.
- 2 Account of the Physiognomy of the Earth, including descriptions of Continents, High Lands, and Low Lands; Plains, including Landes, Steppes, Deserts, and Oases; Groups of Mountains, Chains of Mountains, Groups of Chains of Mountains and single mountains of the different kinds of Valleys; of Caves and Caverns; and of the inequalities of the Submarine land.
- 3 Account of the different kinds of Structure observable in the Solid Mass of the Earth – uses of the Compass and Quadrant explained.
- 4 On the materials of which the mountain rocks are composed.
- 5 Account of Quartz, Felspar, Mica, Hornblende, and Limestone. The minerals of which the greater part of the earth is composed.
- 6 Account of the different classes of rocks, viz, Primitive, Transition, Silurian, Secondary, Tertiary, volcanic, alluvial.
- 7 On the fossil organic remains, their systematic arrangement, and description. Geognostical distribution in the crust of the earth, and that distribution as connected with the state of the earth during the different periods of its formation.

- 8 Particular account of the different rock formations, their importance in the economy of nature, and to mankind.<sup>1</sup>
- 9 On veins; and as connected with them, details in regard to the distribution of metalliferous minerals.
- 10 The phenomena, effects and theory of volcanoes and earthquakes.
- 11 The formation of mountains, valleys, plains and caves.
- 12 Theory of the earth, as deduced from the facts and views previously detailed.
- 13 Deluges and *The Deluge* explained.
- 14 Description and Arrangement of soils or those loose superficial matters that cover the solid strata, and in which plants grow, and many animals live.
- 15 On the connexion of geology with agriculture and planting.
- 16 On the earth as a member of a planetary system, comparison of its form, magnitude, surface, light, atmosphere and changes, with those which have been observed in other parts of the planetary system, especially in the moon and sun.
- 17 Fixed Stars, as seen by the naked eye and the telescope; and the various groupings and arrangement of these, constituting the Grand System of the Universe.
- 18 Geognostical Structure of Scotland, England, and Ireland. Modes employed in searching for Useful Minerals. Mode of conducting Mineral Surveys, of constructing Geognostical Sections and Maps, and of modelling Mountains, Hills, and Plains.”

---

<sup>1</sup> In the syllabus that postdates 1841, the section was changed to: “Particular account of the different neptunian, plutonian, and volcanic rock formations, their importance in the economy of nature, and to mankind”.

## Version 4.

### Class Syllabus, post-1841 (Copy from Bath Public Library)

“This branch of natural history, which makes us acquainted with the various natural and economical relations of simple minerals, is treated in the following manner:

#### 1 Explanation of the language of mineralogy.

**2 Account of the system of mineralogy.** A System founded partly on External and partly on Chemical Characters adopted. – In this system there are three Classes; - Class 1. *Acrogenous* – On Surface-formed Minerals – Gases – Waters – Acids, and Salts. Class 2. *Geognous*, or Minerals of which the known Solid Part of the Earth is chiefly composed – divided into Haloidal Minerals or Tasteless Compounds of Earth and Acids, and Tasteless Compounds of Metals and Acids; Terrigenous or Earthy Minerals – Metalliferous Minerals. Class 3. *Phytogenous Minerals* – Minerals chiefly formed of Mineralized Vegetable Matters ex coal.

#### 3 Descriptions of Simple Minerals

**4 Uses of Simple Minerals in the Arts – Medicine – Agriculture – and in the Economy of Nature,**

#### 5 Physical and Geographical Distribution of Simple Minerals.

## IV Geology

This branch of Natural History treats of the structure and composition of the solid mass of the earth, and its mode of formation. The general cosmological properties of the Globe, its connexion with the planetary system and that of the Universe, are also considered. The following is the order of the lectures.

**Cosmical Properties of the Earth.** – Figure; Magnitude; Density; Electricity; Magnetism; Luminousness; Temperature; Volcanism, including Earthquakes, Volcanoes; permanent upraising and subsidence of the Land; Theory of Earthquakes and of Volcanic Eruptions; and Account of Salses, Gas Springs, and Hot Springs.

**Morphology or Physiognomy of the Earth,** including descriptions of Continents, Islands, Peninsulas, High Lands, and Low Lands; Plains, including Landes, Steppes, Deserts, Llanos, Selvas, Pampas, and Oases; Mountains, including Single Mountains, Chains of Mountains, Groups of Chains of Mountains, Chains of Groups of Mountains, Hilly Land; Valleys; Caves, Caverns; inequalities of the Submarine land.

**Structures observable in the Solid Mass of the Earth** – Structure in general; structure of Mountain-Rocks, Mountain Masses, Mountain Groups, and Crust of the Earth; uses of the Compass and Quadrant explained.

**Known thickness of the Crust of the Earth.**

**Materials of which the Earth is chiefly composed**, as Water, Silica, Alumina, Rocks, Quartz, Felspar, Mica, Hornblende, Limestone, Gypsum, and Coal.

**Petrography or description of the different kinds of Rocks**, according to Composition and Structure. Crystalline Rocks. Siliceous Rocks. Silicate Rocks. Haloidal Rocks. Mechanical or Conglomerated Rocks, etc. Zoogenous Rocks. Phytogenous Rocks, Clays, Sands, etc.

**Rocks, as to modes of Formation**, viz., Plutonian, Metamorphic, Neptunian, Volcanic, and Contemporaneous. Rocks according to Position, viz., Primary, or Azoic, Transition, or Palæozoic, Secondary, Tertiary, Alluvial, Volcanic.

**Details of Palæontology**, under zoology and Botany

**Formation of Mountains, Valleys, Plains, and Caves.**

**Geognostical Groups of different Countries compared as to magnitude.** The vast extent of formations in Switzerland contrasted with the small but very distinctly marked formations in Scotland and England.

**Theories of the Earth.** Hutton, Werner. Relation of Tradition to Paleatology

**Description and Arrangement of Soils** – their Physical and Chemical Characters; Description and Arrangement. The Connexion of Geology with Agriculture, Planting, and the Characters and Distribution of Diseases.

**The Connexion of Geology with agriculture, and the characters and distribution of diseases.**

**Account of the Planetary System.**

**Comparison of the Form, Magnitude, Weight, Surface, Light, and Atmosphere**, of the Sun, Moon, and other members of our Planetary System, with those of the Earth.

**Fixed Stars**, as seen by the naked eye and the telescope; and the various groupings and arrangement of these, constituting the Grand System of the Universe.

**Geognostical Structure of Scotland, England, and Ireland.** Modes employed in searching for Useful Minerals. Mode of conducting Mineral Surveys, of constructing Geognostical Sections and Maps, and of modelling Mountains, Hills, and Plains.

# BIBLIOGRAPHY

## MANUSCRIPT COLLECTIONS

Hall, Sir J. **National Archives of Scotland** Diaries (13), correspondence, papers and drawings related to chemical experiments 1774-1831. (GD 206/2, 237/37).

Hall, Sir J. **National Library of Scotland** Diaries (9) 1783-91, and correspondence 1804-24. (MSS 584, 3220-21, 3813, 4002, 6324-32)

Holland, H. **Landsbokasafn Islands (National library of Iceland), Reykjavik**: MSS Lbs 30 folio, 342c folio, 604 folio; MSS lbs 848 4to, 979 4to, 984 4to, 1150 4to, 3875-6 4to, 4274 4to, 4925 4to; MSS Lbs 1249 8vo, 1754 8vo; MS Varia VI (þjóðskjalasafn).

Jameson, R. **Edinburgh University Library** (in MSS Gen 121-31, MSS Dc 10 passim MS Dk 5.23, Pollock Morris papers MSS Gen 1996-1999). Correspondence and papers, including journal of voyage from Leith to London 1793, notebooks of diaries of tours, mineralogical notes of walks, summary of correspondence, 1793-1819. Lecture notes, student notes on his lectures 1813-36, geological and botanical notes. Family papers.

Jameson, R. **Glasgow University Library**. Hunterian MSS Catalogue of Minerals, 1809.

Jameson, R. **St Andrews University Library**. (in NRA 13132) Correspondence with J D. Forbes 1832-51.

Jameson, R. **National Library of Scotland** (NLS MS 789-792) Correspondence with publishers. (NLS MS 19338-19347) Letters of and to. (NLS MS 7208-7382) Letters of and to (1822). (NLS MS 4014-4030). Letters of and to. (NLS MS 3936) Diary of lecture notes on natural history written by W. Carruthers, 1816-17.

Rennie, J. **National Library of Scotland** MS 2726 "A Comparative View of the Huttonian and Wernerian Theories of the Earth." (1816).

Mackenzie, G. **Natural History Museum, London**. Dawson-Turner Collection.

## PRINTED SOURCES

Allan, T. "On the Rocks in the Vicinity of Edinburgh." *Transactions of the Royal Society of Edinburgh* 6 (1812): 405-433.

- Allan, T. "Remarks on the Transition Rocks of Werner." *Transactions of the Royal Society of Edinburgh* 7, no. 1 (1815): 109-138.
- Anon. "Geological Thermometer, Shewing the Opinions Attributed to Various Geologists with Respect to the Origin of Rocks" *Edinburgh Philosophical Journal* 26 (1822): 376.
- Anon. "Biography of the Late Professor Jameson" *Monthly Journal of Medical Science* 18 Ser (3) (1854): 572-575.
- Bacon, F. *Of the Proficiency and Advancement of Learning, Divine and Humane*. London, 1605.
- Boué, A. *Éssai Géologique sur l'Écosse*. Paris, Courcier, 1820.
- Boué, A. "On the Geognosy of Germany, with Observations on the Igneous Origin of Trap." *Memoirs of the Wernerian Natural History Society* 4, no. 1 (1822): 91-108.
- Boué, A. *Memoires Géologiques et Paleontologiques*, Paris 1832.
- Commissioners. "An Abstract of the General Report of the Royal Commissioners Appointed to visit the Universities of Scotland." . Edinburgh, 1836.
- Commissioners. "Evidence, Oral and Documentary, taken and received by the Commissioners for visiting the Universities of Scotland." . London; 1: The University of Edinburgh; N, 1837.
- Cunningham, R J H. *The Geology of the Lothians*. Edinburgh, 1839.
- Cuvier G, and Jameson R. *Essay on the Theory of the Earth with Geological Illustrations by Professor Jameson*. 5th ed. Edinburgh: William Blackwood, 1827.
- Geikie, Sir A., "Introductory Address: Earth Sculpture and the Huttonian School of Geology." *Transactions of the Edinburgh Geological Society* 2 (1873) 247-268. Read 6 November 1873.
- Geikie, Sir A. *Life of Sir Roderick I. Murchison Vols 1-2*. London: John Murray, 1875.
- Geikie Sir, A. "The Scottish School of Geology." In *Geological Sketches at Home and Abroad*, 286-311. London, 1882 [1871].
- Geikie Sir, A. *Memoir of Sir A C. Ramsay*. London: Macmillan and Co., 1895.
- Geikie Sir, A. *The Founders of Geology*. 2 ed. London, 1905 [1897].
- Geikie Sir, A. *A Long Life's Work: An Autobiography*. London: Macmillan, 1924.
- Gordon, M. *The Home Life of Sir David Brewster*. Edinburgh, 1870.



Grant, Sir A. *The Story of the University of Edinburgh*. 2 vols. London: Longmans, Green and Company, 1884.

Greenough, G. *A Critical Examination of the First Principles of Geology*. London, 1819.

Hall, Sir J., "Observations on the Formation of Granite." *Transactions of the Royal Society of Edinburgh* 3, no. 1 (1794): 8-12.

Hall, Sir J., "Account of a Series of Experiments, Showing the Effects of Compression in Modifying the Action of Heat." *Transactions of the Royal Society of Edinburgh* 6 (1812): 71-185.

Hall, Sir J., "On the Consolidation of the Strata of the Earth." *Transactions of the Royal Society of Edinburgh* 10, no. 2 (1826): 314-329.

Hall, Sir J. "Curious Circumstances Upon Which the Vitreous or Stony Character of Whinstone and Lava Respectively Depend." *Nicholson's journal* 2 (1798): 285-8.

Hall, Sir J. "Experiments on Whinstone and Lava." *Nicholson's journal* 4 (1800): 8-18; 56-65.

Hall, Sir J. "Experiments on Whinstone and Lava." *Transactions of the Royal Society of Edinburgh* 5, no. 1 (1805): 43-75.

Hall, Sir J. "On the Vertical Position and Convolutions of Certain Strata and their Relation with Granite." *Transaction of the Royal Society of Edinburgh* 7, no. 1 (1815a): 139-211.

Hall, Sir J. "On the Revolutions of the Earth's Surface, Parts I and II." *Transactions of the Royal Society of Edinburgh* 7, no. 1 (1815b): 139-211.

Hamilton, W. "Some Particulars of the Present State of Mount Vesuvius." *Philosophical Transactions* l xxvi (1786): 365-80.

Hamilton, W. "Some Particulars of the Present State of Mount Vesuvius." *Philosophical Transactions* (1786).

Headrick, J. "Review of Robert Jameson's *System of Mineralogy*, Vol. 1." *Edinburgh Review* 5 (1804), 64-78.

Headrick, J. "Review of Robert Jameson's *Mineralogy of Dumfrieshire*." *Edinburgh Review* 6 (1805), 229-245.

Hutton, J. "Theory of the Earth; or an Investigation of the Laws Observable in the Composition, Dissolution, and Restoration of Land upon the Globe." *Transactions of the Royal Society of Edinburgh* 1 (1788): 209-304.

Hutton, J. *Theory of the Earth with Proofs and Illustrations*. 2 vols. Edinburgh: William Creech, 1795.

Jameson, L. "Biographical Memoir of the Late Professor Jameson." *Edinburgh New Philosophical Journal* LVII (1854): 1-49.

Jameson, R. "On Granite" *Nicholson's Journal of Natural Philosophy, Chemistry and the Arts* 2 (1802): 225-233.

Jameson, R. "On the supposed Existence of Mechanical Deposits and petrifications in the Primitive Mountains, and an account of petrifications which have been discovered in the newest Flotz-Trapp Formation". *Nicholson's Journal of Natural Philosophy, Chemistry and the Arts* 3 (1802): 13-21.

Jameson, R. Examination of the Supposed Igneous Origin of the Rocks of the Trapp Formation" *Nicholson's Journal* 3 (1802): 111-119.

Jameson, R, "On Cotemporaneous Veins". *Memoirs of the Wernerian Natural History Society* 1 (1808): 1-8. (Read 2<sup>nd</sup> March 1808).

Jameson, R. "Mineralogical Queries" *Memoirs of the Wernerian Natural History Society* 1 (1808): 107-126. (Read 9<sup>th</sup> April and 14<sup>th</sup> March 1808).

Jameson, R. "On Colouring Geognostical Maps" *Memoirs of the Wernerian Natural History Society* 1 (1808): 149-162. (Read 9<sup>th</sup> April 1808).

Jameson, R "On the Topaz of Scotland" *Memoirs of the Wernerian Natural History Society* 1 (1809): 445-453. (Read 9<sup>th</sup> December 1809).

Jameson, R. "On Cryolite". *Memoirs of the Wernerian Natural History Society* 1 (1809): 465-469. (Read 11<sup>th</sup> February 1809).

Jameson, R. "Catalogue of Animals of the class Vermes, found in the Firth of Forth and other parts of Scotland". *Memoirs of the Wernerian Natural History Society* 1 (1809): 556-566. (Read 9<sup>th</sup> December 1809).

Jameson, R. "On the Strontian Lead-Glance Formation" *Memoirs of the Wernerian Natural History Society* 1 (1810): 461-465. (Read 3<sup>rd</sup> February 1810).

Jameson, R. "Outline of the Mineralogy of the Pentland Hills". *Memoirs of the Wernerian Natural History Society* 2 (1811): 178-202. (Read 16<sup>th</sup> February 1811).

Jameson, R, "On Porphyry". *Memoirs of the Wernerian Natural History Society* 2 (1811): 217-221. (Read 14<sup>th</sup> December 1811).

Jameson, R. "On Conglomerated or Brecciated Rocks". *Memoirs of the Wernerian Natural History Society* 2 (1813): 202-217. (Read 4<sup>th</sup> December 1813).

Jameson, R. "On formations; a Paper vindicating the Geological views of Werner from an attack made upon them by the *Edinburgh Review*" *Thomson's Annals of Philosophy* 1 (3) (1813): 191-206

Jameson, R. "Mineralogical Observations" *Thomson's Annals of Philosophy*. 2 (11) (1813): 345-346.

Jameson, R. *Mineralogical Travels through the Hebrides, Orkney and Shetland Islands and Mainland of Scotland*. 2 ed. 2 vols. Edinburgh, 1813.

Jameson, R. 'Account of the author' in Buch L, *Travels through Norway and Lapland*, 1813.

Jameson, R. "Mineralogical Observations" *Thomson's Annals of Philosophy*. 4 (24) (1814): 419-424.

Jameson, R. "Mineralogical Observations and Speculations" *Memoirs of the Wernerian Natural History Society* 2 (1814): 221-232. (Read 8<sup>th</sup> January 1814).

Jameson, R. "On the Geognosy of the Lothians". *Memoirs of the Wernerian Natural History Society* 2 (1814): 618-635. (Read 17<sup>th</sup> December 1814).

Jameson, R. "On the Rocks of Sandstone in Caithness" *Memoirs of the Wernerian Natural History Society*. 3 (1815): 220-225. (Read 24<sup>th</sup> December 1819).

Jameson, R. "Geognosy of East Lothian" *Memoirs of the Wernerian Natural History Society*. 3 (1815): 225-245. (Read 11<sup>th</sup> March 1815).

Jameson, R. "On the Red Sandstone Formation". *Thomson's Annals of Philosophy*. 6 (31) (1815): 13-16.

Jameson, R. "On Mineralogical Survey's" *Thomson's Annals of Philosophy* 7 (38) (1816): 102-105.

Jameson, R. *A Treatise on the External, Chemical and Physical Characters of Minerals*. 2nd ed: Edinburgh, 1816.

Jameson R. *A trip to London, or, The Humours of a Berwick Smack: Interspersed with Topographical Notices* 2 ed. Edinburgh 1816.

Jameson, R. "Geological Remarks on Different parts of Scotland" *Thomson's Annals of Philosophy* 7 (37) (1816): 80.

Jameson, R. "Account of the Wernerian Natural History Society of Edinburgh" *Blackwood's Magazine* 1 (1817): 231

Jameson, R. "Account of a Thunder Storm at Leadhills" *Blackwood's Magazine* 1 (1817): 471

Jameson, R. "Letter from Mr Scoresby to Professor Jameson" *Blackwood's Magazine* 2 (1817): 20

- Jameson, R. "Extract from a letter, from Von Buch to Gay-Lussac, regarding Scoresby" *Blackwood's Magazine* 2 (1817): 185.
- Jameson, R. "A New Arrangement of Minerals" *Blackwood's Magazine* 2 (1817): 299
- Jameson, R. "Notices in Natural History, No 1 Granite Stratified" *Blackwood's Magazine* 2 (1818): 378
- Jameson, R. "Fauna Britannica or British Zoology" *Blackwood's Magazine* 2 (1818): 381
- Jameson, R. "Description of a New Mineral called Pargasite" *Blackwood's Magazine* 2 (1818): 549.
- Jameson, R. "Captain Basil Hall's Voyage to Loo-Choo" *Blackwood's Magazine* 2 (1818): 576.
- Jameson, R. "Discovery of Chromate of Iron in the Shetland Islands" *Blackwood's Magazine* 3 (1818): 463 -
- Jameson, R. "Discovery of Hame in Tiree" *Blackwood's Magazine* 3 (1818)
- Jameson, R. "Huttonian and Wernerian Disputants" *Blackwood's Magazine* 3 (1818)
- Jameson, R. "Use of Petrifications...Vertical" *Blackwood's Magazine* 3 (1818)
- Jameson, R. "Strata in the Isle of Wight" *Blackwood's Magazine* 3 (1818): 583
- Jameson, R. "Mineralogy of India" *Blackwood's Magazine* 4 (1819): 599
- Jameson, R. "O the Rocky Mountain Sheep of the Americas" *Memoirs of the Wernerian Natural History Society*. 3 (1819): 306-314. (Read 18<sup>th</sup> April 1819).
- Jameson, R. "On the Geognostical Relations of Granite, Quartz Rock, and Red Sandstone". *Edinburgh Philosophical Journal* 1 (1819): 109-116.
- Jameson, R. "On the Black Lead, or Graphite of Borrodale, or Ayrshire, and Glenstrathfarran". *Edinburgh Philosophical Journal* 1 (1819): 130-134.
- Jameson, R. "1 Secondary Greenstone and Wacke not of Volcanic Origin. 2 Veins which connect mineral beds together not confined to Trap Rocks. 3 Trap Veins (whin dykes) probably of cotemporaneous Formation with the Trap Rocks they Traverse". *Edinburgh Philosophical Journal* 1 (1819): 138-147.
- Jameson, R. "On the Geognosy of the Cape of Good Hope". *Edinburgh Philosophical Journal* 1 (2) (1819): 283-289.
- Jameson R. "Notice of Scientific Travellers in Brazil" *Edinburgh Philosophical Journal* 1 (2) (1819): 337-341.

Jameson, R. "Geognostical Description of the Neighbourhood of Edinburgh". *Edinburgh Philosophical Journal* 1 (2) (1819): 352-363.

Jameson, R. "Living Toads" *Blackwood's Magazine* 6 (1820): 437.

Jameson, R. "Notice of a Mineralogical Journey through South, North and East Iceland. By John Menge of Hanau in a letter addressed to Professor Jameson: observations by the editor" *Edinburgh Philosophical Journal* 2 (3) (1820): 166-167.

Jameson, R. "Account of Rocks formed by Hot Springs, Torrents of Hot Water, bursting of Subterranean Lakes, Air Volcanoes, and Cold Springs" *Edinburgh Philosophical Journal* 2 (4) (1820): 307-316.

Jameson, R. "Notice of Captain Parry's Voyage of Discovery with a chart of Captain Parry's Discoveries in the Arctic Seas" *Edinburgh Philosophical Journal* 4 (7) (1821): 144-156.

Jameson, R. "On the Rocky Mountain Sheep of the Americans". *Edinburgh Philosophical Journal* 5 (1821): 138-143.

Jameson, R. *Manual of Mineralogy* Edinburgh, 1821.

Jameson, R. "Notes on the Geognosy of the Crif-Fell, Kirkbean, and the Needle's Eye, in Galloway". *Memoirs of the Wernerian Natural History Society*. 4 (2) (1821-23): 541-548. (Read 16<sup>th</sup> April 1814).

Jameson, R. "Speculations in Regard to the Formation of Opal, Wood-stone, and Diamond" *Memoirs of the Wernerian Natural History Society*. 4 (2) (1821-23): 556-562. (Read 22<sup>nd</sup> February 1823).

Jameson, R. "Speculations in Regard to the Formation of Opal Woodstone and Diamond" *Edinburgh Philosophical Journal* 9 (1823): 163-167.

Jameson, R and Leslie J, "On the Value of Water as a Moving Power for Machinery, Illustrated in an extract from a Report in Regard to the Water of Leith" *Edinburgh Philosophical Journal* 13 (1825): 170-172.

Jameson, R, "Report In regard for the Reservoirs Proposed to be constructed on the Water of Leith" 1825. (cf. Jameson and Leslie).

Jameson, R, "General Observations on the former and present Geological Condition of the Countries discovered by Captains Parry and Ross". *Edinburgh New Philosophical Journal* 2 (1827): 104-106.

Jameson, R, (ed). *The Anatomie of Humours*, Edinburgh, 1830.

Jameson, R, J Wilson, and H Murray. *Narrative of Discovery and Adventure in Africa: from the Earliest Ages to the Present Time*. Edinburgh: Oliver and Boyd, 1830.

- Jameson, R, *Mineralogy according to the Natural History System: forming an article under that head in the seventh edition of the Encyclopedia Britannica*. Edinburgh. 1837
- Jameson, R, *Mineralogy According to the Natural History System*. 7th ed. Edinburgh: Charles and black, 1849.
- Jameson, R, *Catalogue of a Valuable Collection of Books*. Edinburgh: Colston and son, 1856.
- Jameson, R, "Is the Huttonian Theory of the Earth Consistent with Fact?" *Royal Medical Society of Edinburgh, Dissertations by Eminent Members of the Royal Medical Society*, 32-39. Edinburgh., 1892.
- Jameson, R, *The Wernerian Theory of the Neptunian Origin of Rocks: A Facsimile Reprint of 'Elements of Geognosy', 1808*. New York: Hafner Press, 1976.
- Jeffrey, F. "Review of John Playfair's, *Illustrations of the Huttonian Theory of the Earth* (1802)." *Edinburgh Review* 1802, 201-216.
- Jeffrey. "Review of John Murray's *A Comparative View* (1802)." *Edinburgh Review* 1803, 337-348.
- Kay, J. *A Series of Original Portraits and Caricature Etchings by the Late John Kay with Biographical Sketches and Illustrative Anecdotes*. Edinburgh: Charles and Black, 1877.
- Kennedy, R. "A Chemical Analysis of Three Species of Whinstone and Two of Lava." *Transactions of the Royal Society of Edinburgh* 5, no. 1 (1805): 76-98.
- Kirwan, R. "Examination of the Supposed Igneous Origin of Stony Substances." *Transactions of the Royal Irish Academy* 5 (1793): 51-87.
- Kirwan, R. "On the Primitive State of the Globe and its Subsequent Catastrophe." *Transactions of the Royal Irish Academy* 6 (1797): 233-308.
- Kirwan, R. *Geological Essays*. London., 1799.
- Kirwan, R. "Observations on the Proofs of the Huttonian Theory of the Earth adduced by Sir James Hall, Bart." *Journal of Natural Philosophy, Chemistry, and the Arts* 4 (1800): 97-102, 153-158.
- Leslie, J, R Jameson, and H Murray. *Discovery and Adventure in the Polar Seas and Regions: with Illustrations of their Climate, Geology and Natural History*. 16th ed. Edinburgh: T Nelson, 1851.
- Lockhart, J. *Peter's Letters to his Kinsfolk*. Edinburgh: Nelson, 1819.
- Lord, D. *Geognosy: Or the Facts and Principles of Geology Against Theories*. New York, 1855.
- Lyell, C. *Principles of Geology*. 3 vols. London: John Murray, 1832.

Lyell, Mrs, ed. *Life, Letters and Journals of Sir Charles Lyell, Bart. Vol 1*. London: John Murray, 1881.

Mackenzie, Sir G. *Travels in the Island of Iceland During the Summer of the Year MDCCCX*. Edinburgh, 1811.

Macknight, T. "On the Mineralogy and Scenery of Certain Districts in the Highlands." *Memoirs of the Natural History Society* 1 (1811): 274-370.

Macknight, T. "On Mineralogical Notices and Observations." *Memoirs of the Natural History Society* 3 (1817): 104-122.

Murray, H. *An Encyclopaedia of Geography* (Assisted by R. Jameson),. Hugh and Cl. 1834.

Murray, H and Jameson, R. *Historical and Descriptive Account of British India*, Edinburgh Cabinet Library.. (n.d.)

Murray, J. *A Comparative View of the Huttonian and Neptunian Systems of Geology: In Answer to the Illustrations of the Huttonian Theory of the Earth by Professor Playfair*. Edinburgh: Edinburgh. Facsimilie Reprint 1978., 1802.

Norton, C, ed. *Early Letters of Thomas Carlyle Vols. 1-2*. London: Macmillan and Co., 1886.

Playfair, J. *Illustrations of the Huttonian Theory of the Earth*. Edinburgh, 1802.

Playfair, J. "Review of Sir James Hall on Heat and Compression." *Edinburgh Review* 1806, 19-31.

Playfair, J. "Review of Sir George Steuart Mackenzie's *Travels in Iceland* (1811)." *Edinburgh Review* 1812, 416-435.

Playfair, J. "Review of Cuvier's *Theory of the Earth* (1813)." *Edinburgh Review* 1814, 454-475.

Scipio, C. *A Sketch of the Politics of the Edinburgh Reviewers as exhibited in their first three volumes*. London, 1807.

Thomson, T. *A System of Chemistry*. 4 vols. Edinburgh: Bell and Bradfute, 1802.

Wilson, L, and A Geikie Sir. *Memoir of Edward Forbes*. Edinburgh: Macmillan and Co., 1861.

## SECONDARY REFERENCES

Agar, J, and C Smith, eds. *Making Space for Science: Territorial Themes in the Shaping of Knowledge* St. Martins, 1998.

Agnarsdóttir, A. "Sir Joseph Banks and the Exploration of Iceland." In *Sir Joseph Banks: A Global Perspective*, edited by R. E. R. Banks [et al], 31-48: Royal Botanic Gardens, Kew, 1994.

Albury, W, and Oldroyd D . "From Renaissance Studies to historical geology in the light of Michel Foucault's 'The Order of Things'." *British Journal for the History of Science* 10 (1977): 187-215.

Allan, D. *Virtue, Learning and the Scottish Enlightenment*. Edinburgh University press, 1993.

Anderson, R . *Education and Opportunity in Victorian Scotland*. Oxford, 1983.

Anderson, R. *Education and the Scottish People*. Clarendon, Oxford, 1995.

Bailey, E. *British Men of Science: Charles Lyell*. Nelson, 1962.

Bailey, E. *James Hutton-the Founder of Modern Geology*. London, Amsterdam, and New York, 1967.

Barnes, B. *Scientific Knowledge and Sociological Theory*. Routledge and Kegan Paul, 1974.

Barnes, B, and S Shapin, eds. *Natural Order: Historical Studies of Scientific Culture*. Sage, 1979.

Barnes, B, D Bloor, and J Henry. *Scientific Knowledge: A Sociological Analysis*.: Univeristy of Chicago press, 1996.

Berry, C J. *Social Theory of the Scottish Enlightenment*. Edinburgh University Press, 1997.

Black, J. *The British Abroad: The Grand Tour in the Eighteenth Century*. Sandpiper, 1992.

Boucher, A. *The Iceland Traveller: A Hundred Years of Adventure*. Iceland Review, 1989.

Bowker, G. "In Defence of Geology: The Origins of Lyell's Uniformitarianism." In *A History of Scientific Thought: Elements of a History of Science*, edited by M Serres: Blackwell, 1989.

Bowler, P. *The Fontana History of the Environmental Sciences*.: Harper Collins, 1992.

Brannigan, A. *The Social Basis of Scientific Discoveries*.: Cambridge, 1981

Brewer, J. *The Pleasures of the Imagination: English Culture in the Eighteenth Century*. Harper Collins, 1997.

Bright, P. *Dr Richard Bright, (1789-1858)*. London: The Bodley Head, 1983.

Broman, T. "The Habermasian Public Sphere and "Science in the Enlightenment"." *History of Science* 36 (2), no. 112 (1998): 123-150.



- Brotsky, P. "Commentaries on the Huttonian Theory of the Earth from *Transactions of the Royal Society of Edinburgh*, 1805-1815." *Earth Sciences History* 2 (1983): 28-34.
- Browne, J. *Charles Darwin: Voyaging*. Vol. 1: Ithaca, 1995.
- Calhoun, C, ed. *Habermas and the Public Sphere*. Mass: Cambridge, 1992.
- Campbell, N, and R Smellie. *The Royal Society of Edinburgh, 1783-1983: The First Two-Hundred Years*. Edinburgh, 1960.
- Campbell, I. "Carlyle and the University of Edinburgh." In *Four Centuries: Edinburgh University Life 1583-1983*, edited by G Donaldson, 53-71. Edinburgh: EUP, 1983.
- Cantor, G. "A critique of Shapin's Social Interpretation of the Edinburgh Phrenology Debate." *Annals of Science* 33 (1975): 245-256.
- Cantor, G. "The Edinburgh Phrenology Debate." *Annals of Science* 32 (1975): 195-218.
- Chaldecott, J. "Scientific Activities in Paris in 1791." *Annals of Science* 24 (1968): 21-52.
- Chalmers, A. *What is this Thing Called Science?* 2nd ed: Open University Press, 1982.
- Chitnis, A.. "The Edinburgh Professoriate, and the University of Edinburgh's Contribution to 19th century British Society." Ph.D, University of Edinburgh., 1968.
- Chitnis, A. "The University of Edinburgh's Natural History Museum and the Huttonian-Wernerian Debate." *Annals of Science* 26 (1970): 85-94.
- Chitnis, A. *The Scottish Enlightenment*. London, 1976.
- Christie, J. "The Origins and Development of the Scottish Scientific Community, 1680-1760." *History of Science* xii (1974): 122-141.
- Clive, J. "The Edinburgh Review." *History Today*, no. December (1952).
- Clive, J. *Scottish Reviewers: The Edinburgh Review, 1802-1815*. London, 1957.
- Cooter R , and Pumfrey S. "Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular culture." *History of Science* 32 (3), no. 97 (1994): 237-267.
- Couper, W. *The Edinburgh Periodical Press: Being a Bibliographical Account of the Newspapers, Journals and Magazines Issued in Edinburgh From the Earliest Times to 1800*. 2 vols. Vol. 2 Bibliography 1711-1800. Stirling: Eneas Mackay, 1908.
- Cunningham, F. *James David Forbes, Pioneer Scottish Glaciologist*. Edinburgh: Scottish Academic, 1990.

- Daiches, D, P Jones, and J Jones. *A Hotbed of Genius: The Scottish Enlightenment, 1730-1790*. Edinburgh, 1986.
- Davie, G. *The Democratic Intellect: Scotland and her Universities in the Nineteenth Century*. Edinburgh: Edinburgh University press, 1961.
- Davies, G. *The Earth in Decay: A History of British Geomorphology, 1578-1878*. London, 1969.
- Dean, D. "James Hutton and his Public, 1785-1802." *Annals of Science* 30 (1973): 89-105.
- Dean, D. "James Hutton on Religion and Geology: The Unpublished Preface to his 'Theory of the Earth' (1788)." *Annals of Science* 32 (1975): 187-193.
- Dean, D. "The Word Geology." *Annals of Science* 36 (1979): 35-43.
- Dean, D. "The Age of the Earth Controversy: Beginnings to Hutton." *Annals of Science* 38 (1981): 435-456.
- Dean, D. "John Playfair and His Books." *Annals of Science* 40 (1983): 179-187.
- Dean, D. *James Hutton and the History of Geology*. Cornell University Press, 1992.
- Desmond, A. and J. Moore. *Darwin*. London. 1991.
- Donovan, A. *Philosophical Chemistry in the Scottish Enlightenment*. Edinburgh University Press, 1975.
- Donovan, A. "James Hutton and the Scottish Enlightenment - Some Preliminary Considerations." *Scotia* 1 (1977): 56-68.
- Donovan, A. "James Hutton, Joseph Black, and the Chemical Theory of Heat." *Ambix* 25 (1978): 176-190.
- Donovan, A, L Laudan, and R Laudan, eds. *Scrutinizing Science: Empirical Studies of Scientific Change*. Kluwer Academic, 1988.
- Dott, R. "James Hutton and the Concept of a Dynamic Earth." In *Toward a History of Geology*, edited by C J Schneer, 122-141, 1969.
- Durrenburger, E, and G Palsson, eds. *The Anthropology of Iceland*. Iowa, 1989.
- Dwyer, J. *Virtuous Discourse: Sensibility and Community in Late Eighteenth Century Scotland*. Edinburgh: John Donald, 1987.
- Emerson, R. "The Social Composition of Enlightened Scotland: The Select Society of Edinburgh, 1754-64." *Studies in Voltaire* 114 (1974): 291-329.

- Emerson, R. "Philosophical Society of Edinburgh, 1768-1783." *British Journal for the History of Science* 18 (1985): 255-303.
- Emerson, R. "Natural Philosophy and the Problem of the Scottish Enlightenment." *Studies in Voltaire* 242 (1986): 243-88.
- Emerson, R. "The Scottish Enlightenment and the End of the Philosophical Society of Edinburgh." *British Journal for the History of Science* 21 (1988a): 33-66.
- Emerson, R. "Science and the Origins and Concerns of the Scottish Enlightenment." *History of Science* 26 (1988b): 333-66.
- Emerson, R. G Girard, and R Runte, eds. *Man and Nature*. London, Ontario: University of Western Ontario, 1982.
- Eyles, V. "James Hutton (1726-1797) and Sir Charles Lyell (1797-1875)." *Nature* 160 (1947): 694-695.
- Eyles, V, and J Eyles. "Some Geological Correspondence of James Hutton." *Annals of Science* 7 (1951): 316-339.
- Eyles, V. "Robert Jameson and the Royal Scottish Museum." *Discovery* (1954): 155-162.
- Eyles, V. "Sir James Hall, Bt. (1761-1832)." *Endeavour* 20 (1961): 210-216.
- Eyles, V. "The Evolution of a Chemist: Sir James Hall." *Annals of Science* 19 (1963): 153-182.
- Eyles, V. "The Extent of Geological Knowledge in the Eighteenth Century." In *Toward a History of Geology*, edited by C J Schneer, 159-183, 1969.
- Farrar, W, and K Farrar. "Thomas Allan, Mineralogist: An autobiographical Fragment." *Annals of Science* 24, no. 2 (1967): 115-120.
- Flinn, D. "James Hutton and Robert Jameson." *Scottish Journal of Geology* 16 (1980): 251-278.
- Fontana, B. *Rethinking the Politics of Commercial Society: The Edinburgh Review 1802-1832*. Cambridge, 1985.
- Ford, B, ed. *The Romantic Age in Britain*. Edited by B Ford, *Cambridge Cultural History of Britain*. Cambridge, 1992.
- Forgan, S. "Context, Image and Function: A Preliminary Enquiry into the Architecture of Scientific Societies." *British Journal for the History of Science* 19 (1986): 89-113.
- Forgan, S. "The Architecture of Display: Museums, Universities and Objects in Nineteenth-Century Britain." *History of Science* 32 (1994): 139-162.

- Foucault, M. *The Order of Things: An Archaeology of the Human Sciences*. Routledge, 1966.
- Foucault, M. *The Archaeology of Knowledge*.: Routledge, 1969.
- Frank, R. *Harvey and the Oxford Physiologists: Scientific Ideas and Social Interaction*. California, 1980.
- Gascoigne, J. *Joseph Banks and the English Enlightenment: Useful Knowledge and Polite Culture*.: Cambridge University Press, 1994.
- Gerstner, P. "James Hutton's Theory of the Earth and his Theory of Matter." *Isis* 69 (1968): 26-31.
- Gerstner, P. "The Reaction to James Hutton's use of Heat as a Geological Agent." *British Journal for the History of Science* 5 (1971): 353-362.
- Gillispie, C. *Genesis and Geology: A Study in the Relations of Scientific Thought, Natural Theology, and Social Opinion in Great Britain, 1790-185*. New York: Harper, 1959.
- Glacken, C. *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century*. California, 1967.
- Golinski, J. "Science in the Enlightenment." *History of Science* 24 (1986): 411-24.
- Golinski, J. *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760-1820*. Cambridge, 1992.
- Golinski, J. *Making Natural Knowledge*. Cambridge, 1998.
- Gooding, D, T Pinch, and S Schaffer, eds. *The Uses of Experiment: Studies in the Natural Sciences*. Cambridge University Press, 1989.
- Gooding, D. *Experiment and the Making of Meaning: Human Agency in Scientific Observation and Experiment*. Edited by N Nersessian, *Science and Philosophy Vol 5*: Kluwer Academic, 1990.
- Goodman, D. *The Republic of Letters: A Cultural History of the French Enlightenment*. New York: Ithaca, 1994.
- Gould, S. *Time's Arrow, Time's Cycle: Myth and Metaphor in the Discovery of Geological Time*. Mass: Cambridge, 1987.
- Green, M T. *Geology in the Nineteenth Century: Changing views of a Changing World*. Ithaca and London, 1982.
- Habermas, J. *The Structural Transformation of the Public Sphere*. Translated by Burger, T and Lawrence, F. Mass: Cambridge, 1989.
- Hallam, A. *Great Geological Controversies*. Oxford: OUP, 1983.

- Hampson, N. *The Enlightenment: An evaluation of its Assumptions, Attitudes and Values*. Penguin, 1990.
- Hankins, T L. *Science and the Enlightenment*. Cambridge, 1985.
- Horn, D. *A Short History of the University of Edinburgh, 1556-1889*. Edinburgh, 1967.
- Jardine, N, J Secord, and E Spary, eds. *Cultures of Natural History*. Cambridge University Press, 1996.
- Jones, J, "The Geological Collection of James Hutton." *Annals of Science* 41 (1984): 223-244.
- Jones, P, ed. *Philosophy and Science in the Enlightenment*. Edinburgh, 1989.
- Jordanova, L, and R Porter, eds. *Images of the Earth: Essays in the History of the Environmental Sciences*. Chalfont St.Giles, Bucks, 1979.
- Kark, R , and D Moore. "The Life, Work, and Geological Collections of Richard Bright, M.D. (1789-1858)." *Archives of Natural History* 1 (1981): 119-151.
- Kark, R. *Physician Extraordinary: Dr Richard Bright, (1789-1858)*. Vermont: Montpelier, 1986.
- Koss, S. *The Rise and Fall of the Political Press in Britain Vol 1: The Nineteenth Century*. London: Hamish Hamilton, 1981.
- Kucklick, H, and R Kohler, eds. *Science in the Field. Osiris, 2nd no 11*. Chicago: Chicago UP, 1996.
- La Vopa, A. "Conceiving a Public: Ideas and Society in Eighteenth-Century Europe." *Journal of Modern History* 64 (1992): 79-116.
- Latour, B. "Give me a Laboratory and I will raise the World." , edited by Knorr-Cetina and Mulkay, 141-170, 1983.
- Latour B, and Woolgar S. *Laboratory Life: The Construction of Scientific Facts*. Princeton, 1979/1986.
- Laudan, L. "The Problem of Consolidation in the Huttonian Tradition." *Lynchos* (1979): 195-206.
- Laudan, R. *From Mineralogy to Geology: The Foundations of a Science, 1650-1830*. Chicago University Press, 1987.
- Lenoir, T, and L Ross. "The Naturalised History Museum." In *The Disunity of Science: Boundaries, Contexts and Power*, edited by P Stump Galison, J: Stanford, 1996.

- Leveson, D J. "What was James Hutton's Methodology?" *Archives of Natural History* 23, no. 1 (1996): 61-77.
- Livingstone, D N. *The Geographical Tradition: Episodes in the History of a Contested Enterprise*. Blackwell, 1992.
- Livingstone, D. "The Spaces of Knowledge: Contributions Toward a Historical Geography of Science." *Environment and Planning D: Society and Space* 13 (1995): 5-34.
- Mayhew, R. "Landscape, Religion and Knowledge in Eighteenth-Century England." *Ecumene* 3, no. 4 (1996): 454-471.
- McElroy, D. *Scotland's Age of Improvement: A Survey of Eighteenth-Century Literary Clubs and Societies*. Wash: Pullman., 1969.
- McIntyre, D. "James Hutton and the Philosophy of Geology." In *Fabric of Geology*, edited by CC Albritten, 1963.
- Morrell, J B. "Practical Chemistry in the University of Edinburgh, 1799-1843." *Ambix* 16 (1969): 66-80.
- Morrell, J. "Thomas Thomson: Professor of Chemistry and University Reformer." In *Science, Culture and Politics in Britain, 1750-1870*, 1-46: Varorium, 1969.
- Morrell, J. "The University of Edinburgh in the Late Eighteenth Century: Its Scientific Eminence and Academic Structure." *Isis* 62 (1971): 158-171.
- Morrell, J. "Science and Scottish University Reform: Edinburgh in 1826." *British Journal for the History of Science* 6 (1972): 39-56.
- Morrell, J. "Reflections on the History of Scottish Science." *History of Science* xii (1974): 81-94.
- Morrell, J, and A Thackray. *Gentleman of Science: The Early Years of the British Association for the Advancement of Science*. Oxford: Clarendon Press, 1981.
- Morrell, J. *Science, Culture and Politics in Britain, 1750-1870*: Variorum, 1997.
- Murchison, R. *The Silurian System*. 2 Vols. London: John Murray, 1839.
- Newbiggin, M I and Flett, J S. *James Geikie: The Man and the Geologist*. Edinburgh: Oliver and Boyd, 1917.
- Newcomb, S. "Laboratory Evidence of Silica Solution Supporting Wernerian Theory" *Ambix* 33. 2/3 (1986) 88-93.
- North, FJ, C Swinton, and W Swinton. *Geology in the Museum*. The Museums Assoc.: Oxford, 1941.

Oldroyd, D. "Sir Archibald Geikie, (1835-1924), Geologist, Romantic, Aesthete, and Historian of Geology: The Problem of Whig Historiography of Science." *Annals of Science* 37 (1980): 441-462.

Oldroyd, D. *The Highlands Controversy: Constructing Geological Knowledge Fieldwork in Nineteenth-Century Britain*. University of Chicago Press, 1990.

Oldroyd, D. *Thinking about the Earth: A History of Ideas in Geology*. Athlone, 1996.

Oldroyd, D. *Sciences of the Earth: Studies in the History of Mineralogy and Geology*. Ashgate, 1998.

Ospovat, A. "The Place of the *Kurze Classification* in the work of A G. Werner." *Isis* 58 (1967): 90-95.

Ospovat, A. "Reflections on A G Werner's *Kurze klassifikation*." In *Toward a History of Geology*, edited by C.J Schneer, 242-256. Mass: Cambridge, 1969.

Ospovat, A. "The Work and Influence of Abraham Gottlob Werner: A Re-evaluation." *Actes du XIIIe Congres International d'Histoire des Sciences* 8 (1974): 123-130.

Ospovat, A. "The Distortion of Werner in Lyell's *Principles of Geology*." *British Journal for the History of Science* 9 (1976): 190-198.

Ospovat, A. "The Importance of Regional Geology in the Geological Theories of Abraham Gottlob Werner: A Contrary Opinion." *Annals of Science* 37 (1980): 433-40.

Ospovat, A. "Romanticism and Geology: Five Students of Abraham Gottlob Werner." *Eighteenth-Century Life* 7 (1982): 105-17.

Peacock, M. "The Geology Of Iceland: The Pioneer work of a Scottish Geologist." *Transactions of the Geological Society of Glasgow* XVII, no. 2 (1925): 185-203.

Peacock, M. "A Contribution to the Petrography of Iceland: Being a Description of the Mackenzie collection of 1810." *Transactions of the Geological Society of Glasgow* XVII, no. 2 (1925): 271-333.

Phillipson, N , and R Mitchison, eds. *Scotland in the Age of Improvement*. Edinburgh University Press, 1970.

Pickering, A, ed. *Science as Practice and Culture*. University of Chicago Press, 1992.

Porter, R. *The Making of Geology: Earth Science in Britain 1660-1815*. Cambridge University Press, 1977.

- Porter, R. "Gentlemen and Geology: The Emergence of a Scientific Career, 1660-1920." *The Historical Journal* 21, no. 4 (1978): 809-836.
- Porter, R. "Creation and Credence: The Career of Theories of the Earth in Britain, 1660-1820." In *Natural Order*, edited by B Shapin and S Barnes, 97-124. Beverly Hills, California, 1979.
- Porter, R. *The Earth Sciences: An Annotated Bibliography*. New York and London., 1983.
- Porter, R. *English Society in the Eighteenth Century*. Penguin, 1990.
- Pottinger, G. *Heirs of the Enlightenment: Edinburgh Reviewers and Writers 1800-1830*. Edinburgh: Scottish Academic, 1992.
- Pyenson L, and Sheets-Pyenson S. *Servants of Nature: A History of Scientific Institutions, Enterprises and Sensibilities*. Harper Collins, 1999.
- Raistrick, A, ed. *The Hatchett Diary*. Truro, 1967.
- Rappaport, R. "Lavoisier's Geologic Activities, 1763-1792." *Isis* 58, no. 3 (1969): 375-384.
- Rappaport, R. "Borrowed Words: Problems of Vocabulary in Eighteenth-Century Geology." *British Journal for the History of Science* 15:1, no. 49 (1982): 27-45.
- Rauschenberg, R. "The Journals of Sir Joseph Banks Voyage up Great Britain's West Coast to Iceland and the Orkneys." *Proceedings of the American Philosophical Society* 117 (1973): 186-226.
- Read, H. *The Granite Controversy*. London, 1957.
- Reith, J. *Life of Dr. John Leyden*. Galasheils: A Walker and Son, 1908.
- Ritchie, J. "Natural History and the Emergence of Geology in the Scottish Universities." *Transactions of the Edinburgh Geological Society* 15 (1952): 297-316.
- Rudler, F W. "Experimental Geology." *Proceedings of the Geologists' Association* 1 (1889): 69-103.
- Rudwick, M J S. "Hutton and Werner Compared: George Bellas Greenough's Geological Tour of Scotland in 1805." *BJHS* 1, no. 2 (1962): 117-135.
- Rudwick, M J S. "The History of the Natural Sciences as Cultural History." , Amsterdam 1975.
- Rudwick, M J S. *The Great Devonian Controversy: The Shaping of Scientific Knowledge Among Gentlemanly Specialists*. University of Chicago Press, 1985.



- Rudwick, M J S. *Scenes from Deep Time: Early Pictorial Representations of the Pre-Historic World*. University of Chicago Press, 1992.
- Rupke, N A. "A Second look: C.C Gillispie's *Genesis and Geology*." *Isis* 85 (1994): 261-270.
- Sarjeant, W. *Geologists and the History of Geology*. Kreiger, 1987.
- Schneer, C, ed. *Toward a History of Geology*. Mass: Cambridge.,: MIT Press, 1969.
- Scott, H W, ed. *Lectures on Geology by John Walker*. Chicago, 1966.
- Secord, J. *Controversy in Victorian Geology: The Cambrian-Silurian Dispute*. Princeton: Princeton University Press, 1986.
- Secord, J. "The Discovery of a Vocation: Darwin's Early Geology." *British Journal for the History of Science* 24 (1991a): 133-157.
- Secord, J. "Edinburgh Lamarkians: Robert Jameson and Robert E. Grant." *Journal of the History of Biology* 24, no. 1 (1991b): 1-18.
- Secord, J. *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation* Chicago: Univeristy of Chicago Press, 2000.
- Shairp, J, P Tait, and A Adams-Reilly. *Life and Letters of James David Forbes, FRS*. London: Macmillan and Co., 1873.
- Shapin, S. "The Royal Society of Edinburgh: A Study in the Social Context of Hanoverian Science." PhD, University of Pennsylvania, 1971.
- Shapin, S. "The Politics of Observation: Cerebral Anatomy and Social Interests in the Edinburgh Phrenology Disputes." *The Sociological Review Monograph* 27 (1979): 139-178.
- Shapin, S. "Homo Phrenologicus: Anthropological Perspectives on an Historical Problem." In *Natural Order: Historical Studies of Scientific Culture*, edited by S Barnes B; Shapin, 41-73: Sage, 1979.
- Shapin, S. "History of Science and its Sociological Reconstructions." *History of Science* 20 (1982): 157-211.
- Shapin, S. *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago: University of Chicago Press, 1994.
- Shapin, S. *The Scientific Revolution*. Chicago: University of Chicago Press, 1996.
- Shapin, S. "Placing the View from Nowhere: Historical and Sociological Problems in the Location of Science." *Transactions of the Institute of British Geographers* 23, no. 1 (1998): 5-13.

- Shapin, S & Schaffer, S. *Leviathan and the Air Pump, Hobbes, Boyle, and the Experimental Life*. 391 vols: Princeton University Press, 1985.
- Shapin, S; Thackray, A. "Prosopography as a Research Tool in History of Science: The British Scientific Community, 1700-1900." *History of Science* 12:1, no. 15 (1974): 1-28.
- Sher, R B. *Church and University in the Scottish Enlightenment: The Moderate Literati of Edinburgh*. Edinburgh: Edinburgh University Press, 1985.
- Shine, H; and Shine H C. *The Quarterly Review Under Gifford: Identification of Contributors 1809-1824*: University of North Carolina Press, 1949.
- Siegfried, R; Dott, R H Jr. *Humphry Davy on Geology: The 1805 Lectures for the General Audience*: Wisconsin, 1980.
- Smout, T C. *A History of the Scottish People: 1560-1830*: Fontana Press, 1969.
- Strout, A L. *A Bibliography of Articles in Blackwood's Magazine 1817-1825*. Lubbock, Texas: Texas Technical College, 1959.
- Sullivan, A, ed. *British Literary Magazines: The Romantic Age, 1789-1836, Historical Guides to the World's Periodicals and Newspapers*. London: Greenwood Press, 1983.
- Sweet, J , and C Waterston. "Robert Jameson's Approach to the Wernerian Theory of the Earth, 1796." *Annals of Science* 23 (1967): 81-95.
- Sweet, J M. "The Wernerian Natural History Society in Edinburgh." *Freiberger Forschungshefte* 167 (1967a): 206-218.
- Sweet, J M. "Robert Jameson's Irish Journal, 1797." *Annals of Science* 23 (1967b): 97-126.
- Sweet, J M. "Robert Jameson and Shetland: A Family History." *Scottish Genealogist* XVI, no. 1 (1969).
- Sweet, J. "Instructions to Collectors: John Walker (1793) and Robert Jameson (1817); with Biographical Notes on James Anderson (LLD) and James Anderson (MD)." *Annals of Science* 29, no. 4 (1972): 397-414.
- Sweet, J M. "Robert Jameson and the Explorers: The Search for the North-West Passage, part 1." *Annals of Science* 31, no. 1 (1974): 21-47.
- Sweet, J M. "Introduction" in Jameson, R. *The Wernerian Theory of the Neptunian Origin of Rocks: A Facsimile Reprint of 'Elements of Geognosy', 1808*. New York: Hafner Press, 1976.
- Taylor, K L. "Nicolas Demarest and Geology in the Eighteenth Century." In *Toward a History of Geology*, edited by C J Schneer, 339-56. Cambridge, Mass.: MIT Press, 1969.
- Taylor, K. "The Historical Rehabilitation of Theories of the Earth." *The Compass* 69 (1992): 334-45.

Teigen, P M. "Supplementary Letters of Sir Joseph Banks, Third Series." *Journal of the Society for Bibliography of Natural History* 7, no. 3 (1975): 249-257.

Tyrrell, G. "Hutton on Arran." *Proceedings of the Royal Society of Edinburgh* 63 (B) (1950): 369-376.

Walters, A N. "Conversation Pieces: Science and Politeness in Eighteenth-Century England." *History of Science* 35 (2), no. 108 (1997): 121-154.

Ward, W S. *Index and Finding List of Serials Published in the British Isles 1789-1832*. Lexington: University of Kentucky Press, 1953.

Waterston, C D. *Collections in Context: The Museum of the Royal Society of Edinburgh and the Inception of a National Museum for Scotland*. National Museums of Scotland, 1997.

Wawn, A. "John Thomas Stanley and Iceland: The Sense and Sensibility of an Eighteenth Century Explorer." *Scandinavian Studies* 53 (1981): 52-76.

Wawn, A. "Gunnlaugs Saga Ormstunga and the Theatre Royal Edinburgh 1812: Melodrama, Mineralogy and Sir George Mackenzie." *Scandinavica* 21, no. 2 (1982): 140-151.

Wawn, A, ed. *The Iceland Journal of Henry Holland, 1810*. London: Hakluyt Society, 1987.

Wawn, A. "The Enlightenment traveller and the idea of Iceland: the Stanley expedition of 1789 reconsidered." *Scandinavica* 28, no. 1 (1989): 5-15.

Werner, A. *On the External Characters of Minerals*. Translated by Carozzi, A: University of Illinois Press, 1962.

West, J F, ed. *The Journals of the Stanley expedition to the Faroe Islands and Iceland in 1789: Diary of Isaac S. Benners*. Vol. 2. Tórshavn: Froya Frøðskaparfelag, 1970.

West, J F, ed. *The Journals of the Stanley Expedition to the Faroe Islands and Iceland: Introduction and Diary of James Wright*. Vol. 1. Tórshavn: Froya Frøðskaparfelag, 1970.

West, J F, ed. *The Journals of the Stanley Expedition to the Faroe Islands and Iceland in 1789: Diary of John Baine*. 3 vols. Vol. 3. Tórshavn: Froya Frøðskaparsetur, 1976.

Wilson, L G. *Charles Lyell the Years to 1841: The Revolution in Geology*. Yale, 1972.

Wilson, E.O. *Consilience: The Unity of Knowledge*. Little, Brown and Co., 1998.

Withers, C. "Improvement and Enlightenment: Agriculture and Natural History in the Work of the Rev. Dr. John Walker." In *Philosophy and Science in the Scottish Enlightenment*, edited by P Jones, 102-116. Edinburgh, 1989.

Withers, C. "Natural Knowledge as Cultural Property: Disputes over the 'Ownership' of Natural History in late Eighteenth-Century Edinburgh." *Archives of Natural History* 19, no. 3 (1992): 289-303.

Withers, C W J. "On Georgics and Geology: James Hutton's 'Elements of Agriculture' and Agricultural Science in Eighteenth-Century Scotland." *The Agriculture Review* 42, no. 1 (1994): 38-48.

Withers, C. "Towards a History of Geography in the Public Sphere." *History of Science* 37, no. 1 (1999): 45-78.

Wood, P. "Science, the Universities, and the Public Sphere in Eighteenth-Century Scotland." *History of Universities* xiv (1994): 99-135.

Woodward, H. *The History of the Geological Society of London*. London, 1907/8.

Wyllie, P G, G Y Craig and J H Hull. *James Hutton Present and Future*. Spec. Pub. Geol. Soc. Lond. 150: 43 (1999).

Yearley, S. "Proofs and Reputations: Sir James Hall and the Use of Classification Devices in Scientific Argument." *Earth Sciences History* 3, no. 1 (1984): 25-43.

Zittel, K. *History of Geology and Paleontology*. Translated by Maria M Olgilvie-Gordon. London, 1901.